



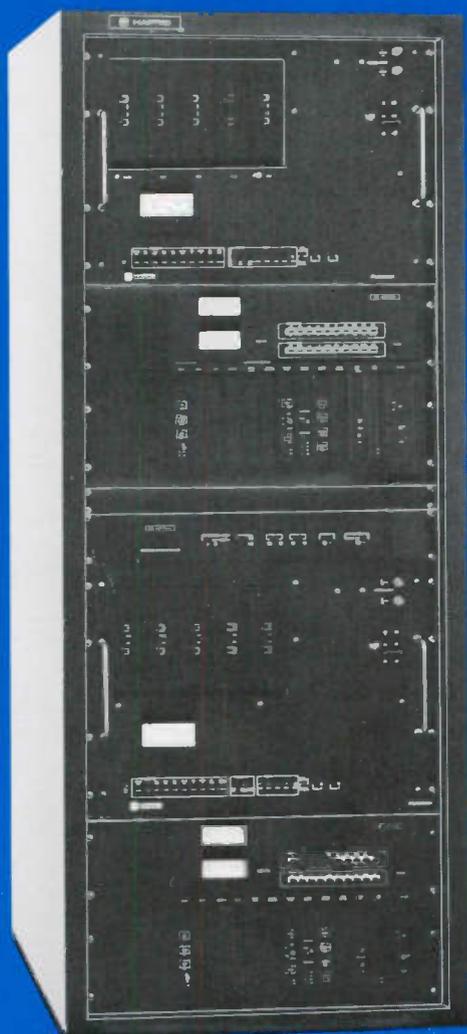
HARRIS

FM-300K

Solid-State 300-Watt FM Transmitter

FM-300KD

Solid-State Main/Alternate 300-Watt
FM Transmitter



FM-300KD Main/Alternate Transmitter

- Advanced solid-state design
- Final Power Amplifier modular design allows continued operation should a PA module fail
- Advanced MX-15 Exciter yields minimum distortion for maximum signal clarity
- Digitally Synthesized Modulation (DSM) Stereo Generator provides 50 dB minimum separation (typically 60 dB at midband) for increased stereo realism
- Dynamic Transient Response (DTR*) stereo generator filter delivers 2 to 6 dB increase in loudness without overmodulating
- Extensive status and monitoring indicators and metering functions minimize costly maintenance and troubleshooting
- Modular construction permits rapid repairs, minimizing down time
- FM-300KD available in three configurations to meet your operational requirements

*Patented

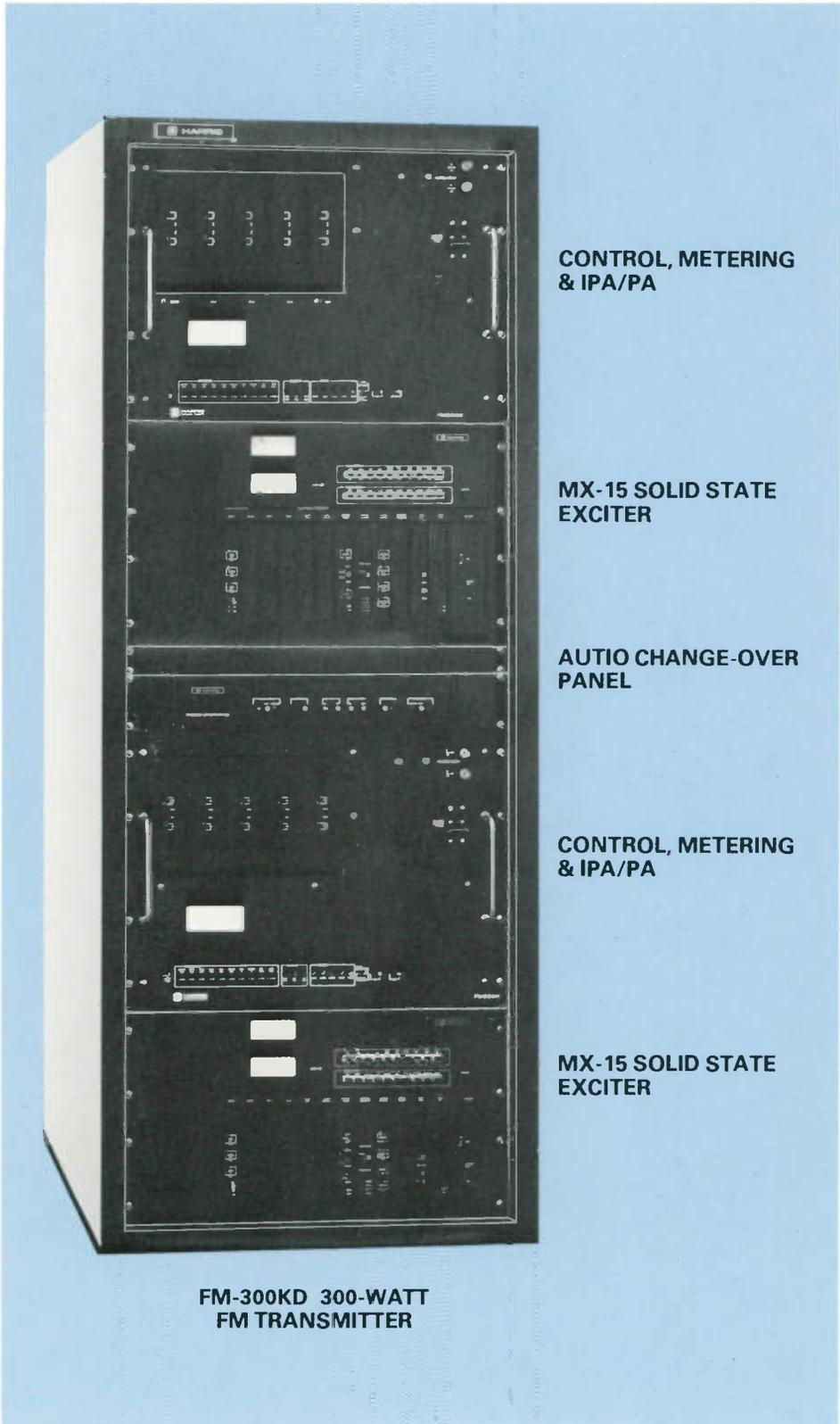
Harris' 300 watt FM transmitter is available in two configurations—the standard model (FM-300K) or the dual FM-300KD which can be equipped for one of three configurations.

1. Separate 300 watt transmitters operating on different frequencies for two program channels.
2. Main/alternate main configuration where one transmitter acts as a full backup to the other transmitter permitting uninterrupted program service should one unit fail.
3. Combined operation yielding 600 watts of power for program services requiring increased coverage area.

Both the FM-300K and the FM-300KD are housed in a single 24 inch wide cabinet. Since the FM-300K only contains one transmitter, the extra cabinet space may be used for monitoring and test equipment.

Both transmitters are 100% solid state for top reliability and represent one of the first all-solid state 300 watt broadband transmitters ever developed. Harris was the first equipment manufacturer to introduce an all solid state radio broadcast transmitter—the MW-1, one kilowatt AM transmitter. The same solid state transmitter engineering experience that has given the MW-1 an excellent reliability and performance track record brings you the Harris FM-300K/KD.

The transmitters also incorporate such Harris-developed features as Digitally Synthesized Modulation (DSM) for the very finest stereo signal available; and the Dynamic Transient Response (DTR) filter, which holds overshoot on any program material to 2% or less. Additional features include automatic recycling; an air cooling system with replaceable dust filter; availability of multiple SCA channels; a wideband input for use with microwave studio-transmitter links; and modular design for ease of maintenance.



**FM-300KD 300-WATT
FM TRANSMITTER**

**CONTROL, METERING
& IPA/PA**

**MX-15 SOLID STATE
EXCITER**

**AUTIO CHANGE-OVER
PANEL**

**CONTROL, METERING
& IPA/PA**

**MX-15 SOLID STATE
EXCITER**

POWER AMPLIFIER (PA)

The power amplifier consists of four modules, each module containing two transistor amplifiers in a highly efficient broadband amplifier circuit. Each module has an individual current protection circuit and voltage regulator. LED status lights indicate the condition of each amplifier. A front panel test point allows a measurement of relative RF power output with a DC voltmeter. The PA RF broadband output com-

biner network allows the failure of an amplifier module without causing an off-air condition. Each module is rated at 100 watts, with transmitter power output 300 watts nominal.

INTERMEDIATE POWER AMPLIFIER (IPA)

The IPA is identical to the PA modules, and can be interchanged with a PA module in the event of an IPA failure for operation at

reduced power. Optimum broadband matching of the input provides a low VSWR to the FM exciter over the entire FM band.

CONTROL CIRCUITS

Control function circuits are provided for transmitter turn on, AFC lock, RF mute, air flow, PA overload, and VSWR protection. Remote control interface is also provided. Status lights with memory are provided for VSWR and amplifier overloads. The transmitters are equipped for AC restart in case of a power failure while on the air.

AUTOMATIC RECYCLING

The recycle circuitry is self-clearing and uncomplicated. Should a momentary overload occur, the transmitter will recycle automatically. If the overload occurs in excess of the number of times pre-set, the transmitter will remain off the air until it is reset, either manually or by remote control.

HARMONIC FILTER

An internal (self-contained) harmonic filter is provided which assures compliance with RF harmonic output requirements. It allows coverage of the entire FM band.

DIRECTIONAL COUPLER

An internal directional coupler provides local and remote indication of both forward output power and reflected power. The reflected power section is connected to the control circuit for the purpose of initiating amplifier shutdown in the event of excessive VSWR.

POWER SUPPLY

The DC power supplies for the control circuits and amplifier modules are capable of operation from any conventional 200-260 VAC, 50/60 Hz single phase AC power supply. The PA RF amplifier modules are supplied by a feedback-type integrated circuit voltage regulator whose output is adjustable with a single front panel control. Each voltage regulator can operate with a continuous short on its output safely, without causing further damage, due to its current foldback capability. The IPA voltage regulator is also adjustable. Cooling is provided for regulator devices. Silicon power rectifiers are used throughout.

METERING

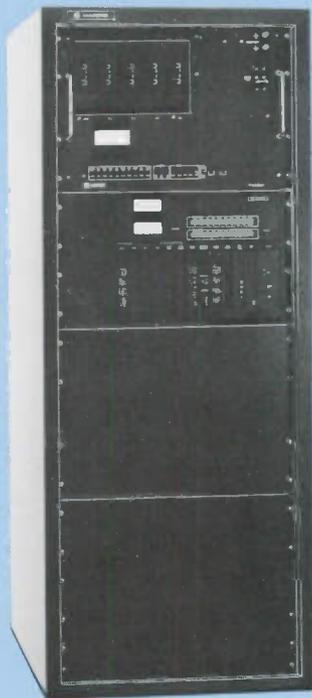
Ample transmitter metering is provided for functions including RF output, VSWR, PA DC input voltages and currents, IPA DC input voltage and current, and unregulated supply voltage. LED indicators on the IPA module and PA module front panels give indication of correct RF output for easy fault location.

QUALITY COMPONENTS

Every transmitter component is conservatively operated and chosen to give optimum performance in continuous duty service.

PLUG-IN MONO, STEREO AND SCA GENERATORS

The FM-300K and FM-300KD transmitters



**CONTROL, METERING
& IPA/PA**

**MX-15 SOLID STATE
EXCITER**

**FM-300K
300-WATT
FM TRANSMITTER**

separation through 15 kHz (60 dB typical at mid band) and an exceptionally clean baseband, promoting minimal interaction between stereo and SCA service. Also, pilot phase is automatically controlled so that high separation can be maintained under varying operating conditions.

OVERSHOOT COMPENSATION

A Dynamic Transient Response (DTR) filter has been developed and patented by Harris for FM stereo, with overshoot no greater than 2% on any program material processed by any limiter. As a result, from 2 to 6 dB increased loudness can be achieved without degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk, and low intermodulation distortion are all maintained with increased loudness. For monaural stations wishing to protect SCA channels, a defeatable linear phase low pass filter is provided for optimal linear control of overshoot.

SCA OPERATION

Multiple SCA operation can be accommodated by the FM-300K/KD transmitters. The ultra linear modulation quality of the Harris MX-15 FM Exciter yields minimum interaction and degradation between mono/stereo signals and the SCA channels.

Up to two standard SCA generators can be housed within the exciter. The simple plug-in modular construction permits easy incorporation of SCA at time of order or at a later date in the field. Additional external SCA generators are accommodated through baseband input ports.

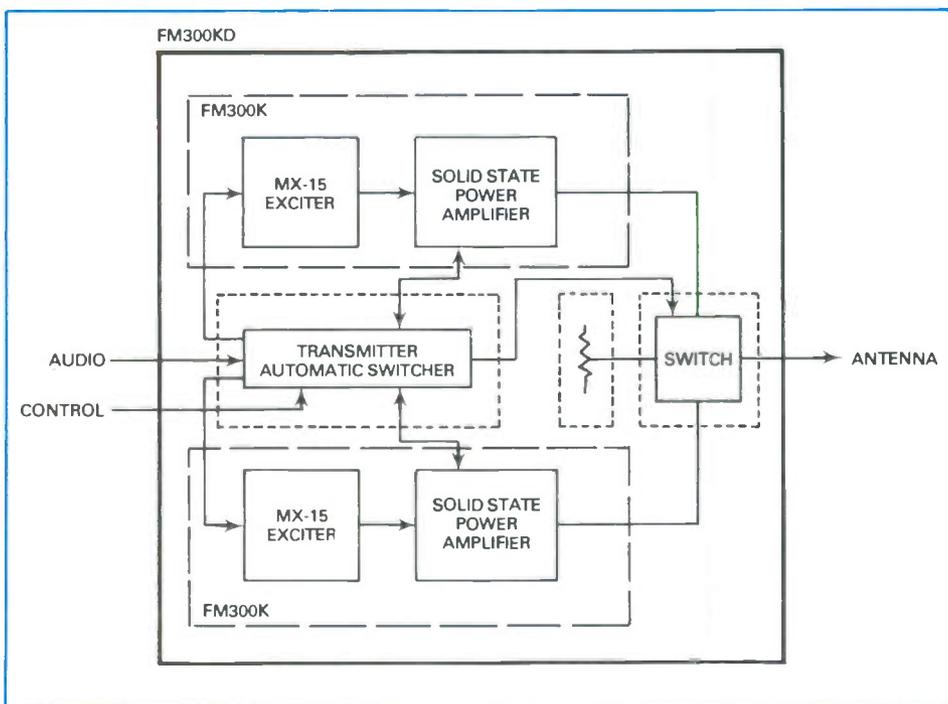
The standard SCA generator can operate at either 67 kHz or 92 kHz with other frequencies available upon request. Pre-emphasis is selectable for 150, 75, 50 or 0 microseconds. The audio input is applied to a programmable low pass filter and the output of the SCA generator filtered. 150 microseconds pre-emphasis can be used with no degradation of SCA to main channel crosstalk.

Each SCA module has a pair of modulation inputs, one balanced and AC coupled for audio, and the other DC coupled for data and video transmission.

The subcarrier level is adjustable to provide from 1% to 30% composite baseband SCA injection. When an SCA subcarrier is turned on or off, a patented automatic composite level switcher noiselessly compensates for the change in baseband injection level. 100% peak modulation is maintained independent of SCA status.

ADDITIONAL EXCITER FEATURES

The MX-15 exciter RF output power is 3 to 15 watts into 50 ohms, continuously adjustable by one control. A directional coupler samples and meters forward and reflected power, with remote metering capability. A harmonic filter is placed at the RF module output, reducing harmonics to a low level. The balanced 600 ohm audio input is trans-



Block diagram of FM-300KD main/alternate transmitter system, with optional equipment shown inside dotted lines.

may be equipped for mono or stereo operation, with or without SCA. The design versatility allows you to order for mono operation originally, then add stereo and/or SCA at a later date by plugging the appropriate module(s) into the exciter. Since the SCA generators have spectrally pure filtered outputs, multiple SCA channels may be operated simultaneously while in the mono mode without harmonic interference.

DIGITALLY SYNTHESIZED MODULATION (DSM)

The DSM stereo generator is an advanced development which eliminates the tradeoff that exists between switching type and balanced modulator types of stereo generators—poor separation at high frequencies in the former or poor harmonic rejection and SCA crosstalk in the latter. The DSM stereo generator provides 50 dB

formerless to give maximum common mode rejection and excellent transient response. Inputs will withstand high transients or steady voltages above or below ground reference.

The transmitters can be quickly and easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz incre-

ments. Carrier frequencies are generated through a digital synthesizer which is locked to 10 MHz TCXO high stability frequency standard. The TCXO has improved crystal aging characteristics and does not require an oven. The TCXO output may be conveniently and directly compared with any one of several worldwide frequency standards.

EASE OF MAINTENANCE

The transmitters are modular for ease of trouble-shooting and maintenance. An extender card is provided to allow easy servicing. Extensive metering is provided, and LED status lights on the exciter modules indicate various performance features.

FM-300K/FM-300KD SPECIFICATIONS

GENERAL

POWER OUTPUT: 300 watts.
FREQUENCY RANGE: 87.5 to 108 MHz. Exciter programmable in 50 kHz increments. IPA and PA wideband.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: Type N female.
FREQUENCY STABILITY: ± 300 Hz 0° to 45° C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation (DCFM).
MODULATION CAPABILITY: ± 100 kHz.
AC INPUT POWER: 208 to 245 VAC, 50 to 60 Hz. Single phase, $\pm 5\%$ variation.
RF HARMONICS: 60 dB or better.
ALTITUDE: 12,000 ft. (3658 meters) maximum at rated ambient.
AMBIENT TEMPERATURE RANGE: 0° C to $+50^\circ$ C.
HUMIDITY: Up to 95% non-condensing.
MAXIMUM VSWR: 1.2 to 1.
OVERALL CABINET SIZE: Approx. $27\frac{3}{4}$ " W \times $71\frac{3}{4}$ " H \times $29\frac{3}{4}$ " D (70.5 cm \times 182.3 cm \times 75.6 cm).
FINISH: White, blue and black.

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ± 75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%
COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 65 dB below reference carrier AM modulation 100% output power: (300 watts).

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
AUDIO INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation.

AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.

INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.

OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.

AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.

HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.

INTERMODULATION DISTORTION: (Left or right) 0.1% 60 Hz/7 kHz test tone pair, 4:1 ratio.

CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 80 dB (reference 14 kHz/15 kHz test tone pair).

STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.

DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.

LINEAR CROSSTALK: -52 dB.

NON-LINEAR CROSSTALK: -60 dB.

76 kHz SUPPRESSION: -68 dB.

38 kHz SUPPRESSION: -73 dB.

FM NOISE: (Left or right) -74 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.

PILOT OSCILLATOR: Crystal controlled.

PILOT PHASE: Harris patented automatic pilot phasing circuit.

PILOT STABILITY: 19 kHz ± 1 Hz 0° to 50° C.

OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right) — remoteable.

SCA OPERATION

MODULATION: Direct FM.

FREQUENCY OF OPERATION: 67 or 92 kHz programmable, other frequencies available on special order.

FREQUENCY STABILITY: ± 500 Hz.

MODULATION CAPABILITY: ± 7.5 kHz.

AUDIO FREQUENCY RESPONSE: 67 kHz and 92 kHz AC coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ± 0.5 dB.

AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.

AC INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.

DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.

INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.

HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ± 5 kHz deviation.

INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).

FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = ± 5 kHz deviation at 400 Hz).

CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.

CROSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ± 5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.

CROSSTALK: SCA to SCA (67 kHz/92 kHz) 50 dB demodulated with 150 microsecond de-emphasis.

AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.

MUTE DELAY: Adjustable 0.5 to 20 seconds.

INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Specifications subject to change without notice.

ORDERING INFORMATION

FM-300K, 300 Watt All Solid-State Transmitter—mounted in a 24" cabinet, for 50/60 Hz operation. 50 ohm type N female connector, equipped for wide band operation 994-8296-001
FM-300KD, Basic, Two Identical 300 Watt All Solid-State Transmitters—mounted in a single 24" cabinet, for 50/60 Hz operation, 50 ohm type N female output connectors. Equipped for wide band operation with STL 994-8297-001

HARRIS CORPORATION BROADCAST GROUP

P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200



HARRIS

FM-100K

100 Watt
FM Transmitter

- Two separate configurations (complete transmitter, or stand alone 100 watt amplifier)
- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Feed Forward amplification used in 100 watt amplifier provides built-in backup
- 100 watt amplifier can be driven with virtually any 10 watt exciter
- Easy to read control and status indicators aid operation and service

Two separate configurations give the Harris FM-100K flexibility to meet the needs of low power, Class D Educational broadcasters and International broadcasters requiring low power FM stations for broadcasting or program relay.

The standard FM-100K is a complete transmitter, incorporating the solid-state 100 watt broadband amplifier and the high-performance MX-15 exciter. The FM-100K 100 watt amplifier is available as a separate unit and can be driven with virtually any 10 watt exciter.

The FM-100K amplifier and MX-15 exciter both mount in a standard 19-inch equipment rack. Tolerating temperatures from 0°C to 50°C, the complete transmitter is uniquely suitable for broadcasting environments and eliminates the need for heating or air conditioning equipment to maintain operating stability.

The amplifier can be driven with the MX-15 exciter or with most other exciters delivering 10 watts of power. Low power educational broadcasters desiring a power increase to Class A channel requirements will find this unit superbly suited to their needs. A simple connection to the existing 10 watt exciter/transmitter is all that's required.

PLUG-IN POWER AMPLIFIER MODULE

The heart of the FM-100K transmitter is the plug-in 100 watt amplifier module. This power module, providing reliable service in hundreds of worldwide installations, is the same one used in the field-proven Harris FM-300K and FM-25K transmitters. The module contains two RF transistors along with a common solid-state voltage regulator. The regulator controls collector voltage of the transistor stage, permitting continuous transmitter output power variance over a 10 to 100 watt range. By varying the collector voltage of the transistor stage rather than the RF drive, high PA efficiency is maintained over a wide output power adjustment range.

EXTENSIVE AMPLIFIER PROTECTION

The solid-state regulator performs several other important functions, including automatic current fold-back. Should a short develop in one of the transistors, the regulator senses excessive current draw and shuts down the amplifier. Should a fault occur, the automatic current fold-back feature limits excessive current and minimizes dissipation and resultant damage. The solid-state



FM-100K TRANSMITTER

Harris' FM-100K Transmitter with Feed Forward Amplification



regulator also implements VSWR protection. Should a high antenna VSWR be detected by the built-in directional coupler, the voltage regulator automatically turns down the supply voltage to the amplifier.

FEED FORWARD AMPLIFICATION

The FM-100K utilizes a circuit called Feed Forward Amplification. Figure 1 shows in detail how the Feed Forward Amplifier works. The left block diagram depicts a conventional combiner configuration. Here a 20 watt input signal is split into equal 10

watt signals, which are amplified by PA stages into two 50 watt signals. These 50 watt signals are then combined to yield 100 watts. Unfortunately, in this conventional configuration 20 watts of drive signal is required for 100 watts output, precluding the use of most exciters as drivers.

Harris has devised a unique RF amplifier which resolves the problems of conventional combining, the Feed Forward Amplifier, shown in the right portion of figure 1. Here a 10 watt signal is amplified by PA

stage "B" to yield 55 watts. The 55 watts is asymmetrically split into a 45 watt and 10 watt signal. The 10 watt signal is further amplified by PA stage "A", while the 45 watt signal is fed forward through a delay compensation network to the output combiner. Hence the term "Feed Forward". Phase error between the two signals is eliminated by the delay compensation network, assuring proper output combining. The Harris Feed Forward Amplifier obtains 100 watts output power from 10 watts of drive signal.

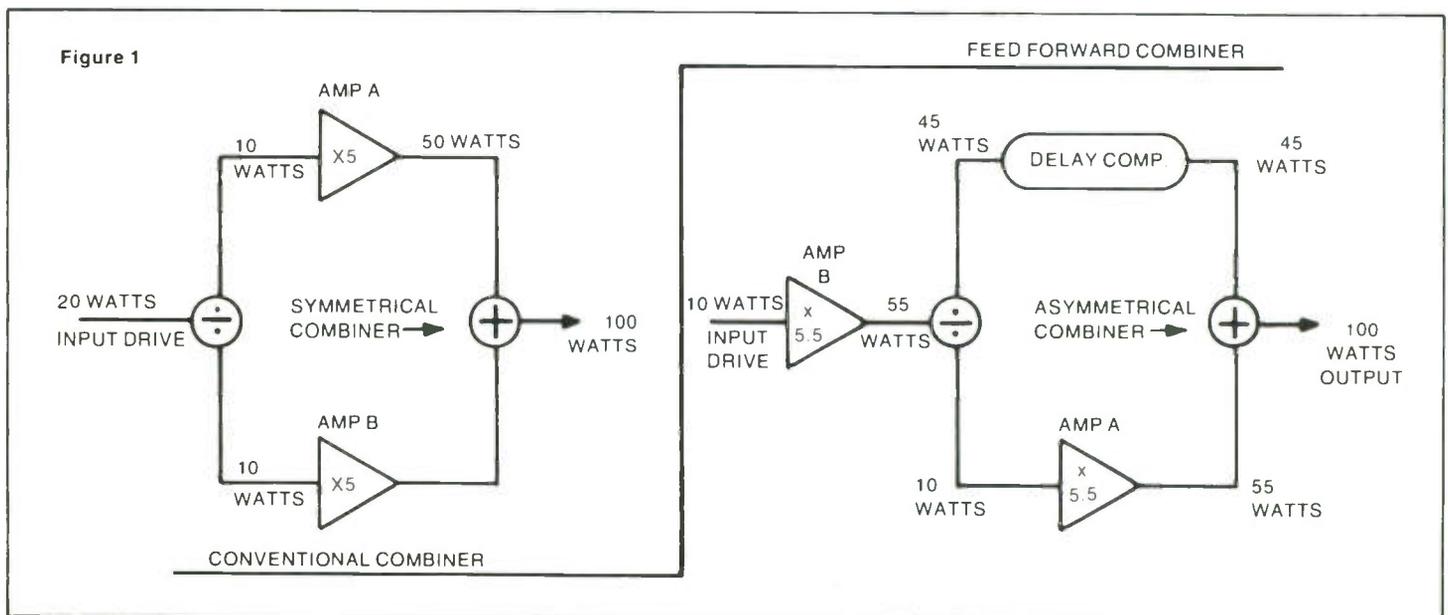
BUILT-IN REDUNDANCY

Built-in redundancy gives the FM-100K amplifier a fail-safe capability. If an RF transistor fails, you can remain on the air at a reduced power of 55 watts by simply patching around the defective stage. Just unplug the printed circuit combiner board, rotate it 90°, and plug it back in. No clip leads to install; no wires to reposition.

CONTROL AND STATUS INDICATORS

From the large 4" front panel meter, you can quickly read five major operating parameters: PA collector voltage; PA collector current; forward power; VSWR; and input drive level. The RF amplifier module also incorporates two LED "go/no-go" status indicators monitoring each PA transistor.

Remote control provisions are built-in. Samples are provided for remote indication of collector voltage, collector current, and forward power. Remote on/off, along with raise and lower power, requires only momentary low current contact closure. This permits direct connection to most remote control systems, eliminating the cost of interface panels.



Harris MX-15 Exciter . . . new levels of excellence in FM audio performance



Continuing in its trend-setting tradition, Harris has incorporated state-of-the-art refinements in exciter technology to introduce the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter provides the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low .02%, with all CCIF Intermodulation distortion products down at least 80 dB. This important criterion shows the quality of the VCO—the heart of any exciter. Distortion, as a result of non-linearities, severely limits stereo and SCA performance. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ± 100 kHz.

Equally impressive is the MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the exciter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise provides your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

DIGITAL SYNTHESIZER

The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system.

The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison against WWV transmissions on these frequencies. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ± 10 MHz range in a maximum of five seconds, starting from an

unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.

DIGITALLY SYNTHESIZED MODULATION

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike older technology, still on the market, that suffers from degraded separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk, Harris' DSM technique has neither of these shortcomings. DSM stereo generation is essentially transparent to the program material. Separation is specified at 50 dB over the 30-15,000 Hz range.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION

A patented Dynamic Transient Response (DTR) filter, developed by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION

Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation all the time. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation head room when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER

The MX-15 power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL BENEFITS

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadrasonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.

FM-100K TRANSMITTER SPECIFICATIONS

AMPLIFIER ONLY

FREQUENCY RANGE: 87.5-108 MHz.
POWER OUTPUT: 100 watts.
DRIVE REQUIREMENT FOR 100 WATT TPO: 10 watts.
LINE VOLTAGE: 110-125 Vac (230 Vac 50-60 Hz available)
250 watts.
PA EFFICIENCY: 55%.
ALTITUDE: 3658 meters (12,000 feet).
TEMPERATURE: 0°C - 50°C ambient @ sea level (derate maximum operating temperature 2°C/1000 feet).
DIMENSIONS: 17" wide x 5¼" high x 15" deep.
SHIPPING WEIGHT: Domestic - apx. 45¼ lbs (21 kg).
Export - apx. 57¼ lbs (26 kg).
HARMONIC SUPPRESSION: Better than 66 dB.
REMOTE CONTROL: Standard.
FM NOISE CONTRIBUTION: 1 dB Maximum¹.
AM NOISE CONTRIBUTION: 3 dB Maximum¹.
OUTPUT IMPEDANCE: 50 ohms (1.2:1 for full performance VSWR protected)
CONNECTORS: PA input and mod amplifier sample - BNC Output-N Connector.
ACTIVE STAGES: 2 PA transistors.
1 regulator.

¹To FCC type accepted 10 watt transmitter.

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: +0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 73 dB below reference carrier AM modulation 100% output power: 15 watts.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: .045%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: +10 dBm, ±1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 80 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -52 dB.
NON-LINEAR CROSSTALK: -60 dB.
76 kHz SUPPRESSION: -68 dB.
38 kHz SUPPRESSION: -73 dB.
FM NOISE: (Left or right) -74 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ±75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ±1 Hz 0° to 50°C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—remoteable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 41 or 67 kHz programmable, any frequency between 25 and 75 kHz on special order.
FREQUENCY STABILITY: +500 Hz.
MODULATION CAPABILITY: +7.5 kHz.
AUDIO FREQUENCY RESPONSE: 41 kHz and 67 kHz AC coupled input, 150 microsecond pre-emphasis ±1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ±0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ±1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ±5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = ±5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ±5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 kHz/67 kHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Specifications subject to change without notice.

ORDERING INFORMATION

FM-100K Transmitter with MX-15 exciter for wideband operation	994-8453-001
100 Watt FM Amplifier	994-8453-002
Mono Module for mono operation	994-8019-001
DSM Stereo Generator for stereo operation	994-8020-001
SCA Generator for SCA operation (specify 41 and/or 67 kHz)	994-7992-001

HARRIS CORPORATION BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200



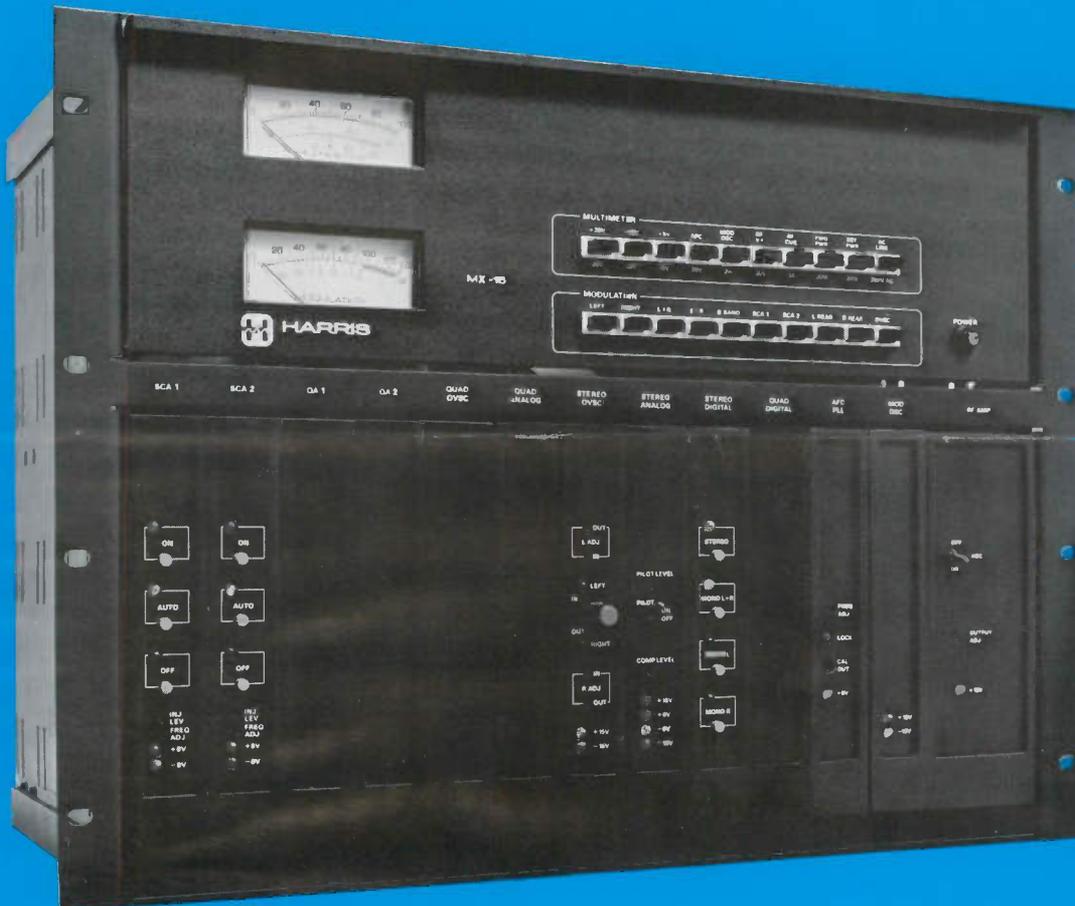
HARRIS

MX-15

Maximum Signal FM Exciter

- Improved ultra linear VCO yields -80 dB FM S/N, and $.02\%$ Intermodulation Distortion for maximum signal clarity
- DSM (Digitally Synthesized Modulation) Stereo Generator provides 50 dB separation minimum—typically 60 dB midband—for increased stereo realism
- DTR* (Dynamic Transient Response) stereo generator filter maximizes modulation level without overmodulating
- Automatic stereo pilot phase control* and digital circuitry provide long term adjustment-free performance
- Balanced floating composite input minimizes system interface problems
- Available as an FCC type accepted 15 watt transmitter

*Patented



HARRIS MX-15 . . .

Continuing in its trend-setting tradition, Harris has incorporated state-of-the-art refinements in exciter technology to introduce the MX-15 FM Exciter. Using various advanced techniques, such as DRT (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter provides the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation

Distortion is an exceptionally low .02%, with all CCIF Intermodulation distortion products down at least 80 dB. This important criterion shows the quality of the VCO—the heart of any exciter. Distortion, as a result of nonlinearities, severely limits stereo and SCA performance. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ± 100 kHz.

Equally impressive is the MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the exciter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise provides your station with maximum signal clarity. The unique

VCO of the MX-15 features superb linearity not found in conventional modulated oscillator designs.

BALANCED FLOATING COMPOSITE INPUT

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

DIGITAL SYNTHESIZER

The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase



The Harris MX-15 Exciter features modular construction for maximum versatility and ease of maintenance.

NEW LEVELS OF EXCELLENCE IN FM AUDIO PERFORMANCE

locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison against WWV transmissions on these frequencies. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ± 10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC pass-band is narrowed, maximizing FM signal to noise.

DIGITALLY SYNTHESIZED MODULATION

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike older technology, still on the market, that suffers from degraded separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk, Harris' DSM technique has neither of these shortcomings. DSM stereo generation is essentially transparent to the program material. Separation is specified at 50 dB over the 30-15,000 Hz range.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION

A Dynamic Transient Response (DTR) filter, developed by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION

Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation all the time. Here's how: when the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the



The Harris DSM Stereo Generator, with Digitally Synthesized Modulation (DSM) and DTR filter, provides 50 dB stereo separation minimum, 30-15,000 Hz, and overshoot no greater than 2%.

SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER

The power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/

no-go" service checks.

ADDITIONAL BENEFITS

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.

MX-15 SPECIFICATIONS

GENERAL

POWER OUTPUT: 3 watts to 15 watts continuously variable.
FREQUENCY RANGE: 87.5 MHz to 108 MHz tested to one specified frequency. (exciter programmable to 50 kHz channel spacing).
RF OUTPUT IMPEDANCE: 50 ohms, open and short circuit proof.
OUTPUT CONNECTION: Female BNC.
FREQUENCY STABILITY: ± 300 Hz 0° to 50°C temperature compensated reference oscillator.
TYPE OF MODULATION: Direct carrier frequency modulation (DCFM).
MODULATION CAPABILITY: ± 100 kHz.
AC INPUT POWER: 100 to 130 VAC or 200 to 250 VAC, 60 Hz or 50 Hz, 150 watts.
RF HARMONICS: Suppression meets all FCC requirements for 10 watt and 15 watt educational transmitter requirements.
ALTITUDE RANGE: 15,000 feet.
AMBIENT TEMPERATURE RANGE: 0° to 50°C (operational to -20°C).
OVERALL CABINET SIZE: 17.7" Wide (44 cm) \times 14" High (35 cm) \times 12" Deep (30 cm). 19" EIA rack mounting standard.
FINISH: Black.
CONSTRUCTION: Main printed circuit boards individually enclosed, plug-in modules. Module service extender board included.
AUDIO/CONTROL CONNECTIONS: Two 18 terminal barrier strips paralleled by 36 pin and socket connectors. RFI bypassing on input/output lines.
MODULATION METER: 10 position, fast rise time AC metering (adjustable to meet FCC ballistics).
MULTIMETER: 10 position, DC metering.
TOTAL METERING FUNCTIONS: 20.
REMOTE METERING PROVISIONS: PA voltage, PA current, forward power, reflected power.
STATUS INDICATION: 27 independent LED indicators (when equipped with all options).

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ± 75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 73 dB below referenced carrier AM modulation; 100% output power; 15 watts.
SYNCHRONOUS AM SIGNAL TO NOISE: 51 dB below referenced carrier with 100% AM modulation @ 400 Hz, 75 microsecond de-emphasis (FM modulation + 75 kHz @ 400 Hz).

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: .045%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
AUDIO INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 80 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -52 dB.
NON-LINEAR CROSSTALK: -60 dB.
76 KHZ SUPPRESSION: -68 dB.
38 KHZ SUPPRESSION: -73 dB.
FM NOISE: (Left or right) -74 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ± 1 Hz 0° to 50°C .
OPERATIONAL MODES: Stereo, mono (left and right), mono (left) — remoteable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 41 or 67 kHz programmable, any frequency between 25 and 75 kHz on special order.
FREQUENCY STABILITY: ± 500 Hz.
MODULATION CAPABILITY: ± 7.5 kHz.
AUDIO FREQUENCY RESPONSE: 41 kHz and 67 kHz AC coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ± 0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ± 5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = ± 5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ± 5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 kHz/67 kHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Harris maintains a policy of continuous improvement on its equipment, and therefore reserves the right to change specifications without notice.

ORDERING INFORMATION

MX-15 Exciter for wideband composite operation, 19-inch rack mounted	994-7950-003
Mono option (add for mono operation)	994-8019-001
DSM Stereo Generator with DTR Filter (add one for stereo operation)	994-8020-001
SCA Generator (add one for each SCA service, specify 41 kHz or 67 kHz)	994-7992-001
External SCA Generator Jumper Card (for use with externally mounted SCA Generator)	994-8377-001

HARRIS CORPORATION BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200



HARRIS
COMMUNICATIONS AND
INFORMATION HANDLING

MS-15R

FM STEREO GENERATOR

- Drives composite Studio-Transmitter Links or wideband input of any FM exciter
- Uses the same Digitally Synthesized Modulation (DSM) and Dynamic Transient Response (DTR) plug-in modules as Harris' MS-15 FM exciter
- Output module features a true peak reading Light-Emitting Diode (LED) display of all stereo functions
- Active transformerless inputs for best transient response
- Low output impedance for driving lengths of coaxial cable
- Digital circuitry design reduces adjustments to a minimum
- Unique compensation circuit for use with STL's
- All operating controls are on the front panel
- Modular construction for ease of maintenance
- Standard 19-inch rack mounting

The MS-15R stereo generator is an exclusive Harris development that features Digitally Synthesized Modulation (DSM) and Dynamic Transient Response (DTR). This generator offers the quality-minded FM broadcaster the first real advancement in stereo generation in a decade—and obsoletes switching and balanced modulator forms of stereo generation.

While these earlier types of stereo generation suffer from degraded separation at the lower and upper frequency limits (30 Hz and 15 kHz), and/or poor harmonic rejection resulting in degraded crosstalk, DSM has neither of these trade-offs. This results in the cleanest-sounding stereo performance of any stereo generator. Minimum separation is 45 dB from 30 to 15,000 Hz and typical separation will exceed 50 dB over this entire band. Since this exceeds the guaranteed accuracy of most modulation monitors, carefully calibrated test equipment is required to measure the actual performance of the MS-15R.

The high performance characteristics of the DSM generator are easy to maintain year after year. The digital circuitry reduces user adjustments to a minimum, and these adjustments are relatively non-critical in nature. An "automatic" pilot phase control assures long-term stability of this critical parameter.

OVERSHOOT COMPENSATION. The Dynamic Transient Response filter, developed by Harris for FM stereo, holds overshoot on any program material to 2% or less, and can be used with any FM limiter. As a result, from 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness.

GENERAL. The modular MS-15R is ruggedly constructed and designed for rack mounting. A positive guidance system permits easy removal and reinsertion of modules, which can be serviced from the front of the generator.



Audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent transient and frequency response. Inputs will withstand high transients or steady state voltages above or below ground level.

LED status indicators are used throughout to aid in troubleshooting. A peak-reading audio LED display aids in set-

ting up the stereo generator, and also serves as an accurate peak program indicator.

The MS-15R can be used with any FM exciter that will accept a wideband input, and is FCC type accepted for use with the Harris MS-15 exciter.

MS-15R SPECIFICATIONS

AC INPUT POWER: 100 to 130 VAC or 200 to 260 VAC, 60 Hz or 50 Hz, 25 W.

HUMIDITY RANGE: 0 to 95% relative humidity, non-condensing.

ALTITUDE: 15,000 feet A.M.S.L.

AMBIENT TEMPERATURE RANGE: 0° C to +50° C (operational to -20° C).

OVERALL CABINET SIZE: 17.6 in. wide (44.7 cm) x 3.5 in. high (8.9 cm) x 15.8 in. deep (40.1 cm). (19-inch rack mounting standard). Net weight: 18 pounds (8.2 kg).

FINISH: Black with white lettering.

AUDIO/CONTROL CONNECTIONS: 12-position barrier strip.

MODULATION METERING: Output module features a true peak reading LED display of Left, Right, L+R, L-R, Pilot Injection and Composite Levels.

COMPOSITE OUTPUT LEVEL: Adjustable from less than 1 V RMS to greater than 4.5 V RMS for 100% modulation.

COMPOSITE OUTPUT IMPEDANCE: 150 ohms unbalanced, resistive (BNC connector).

EXTERNAL COMPOSITE INPUT FOR ADDITIONAL SCA'S OR TELEMETRY: 10K resistive, unbalanced, BNC connector. Amplitude response ± 0.25 dB, 30 Hz to 75 kHz.

COMPOSITE BASEBAND COMPENSATION: Compensator provides separate amplitude and phase compensation for STL or modulated oscillator deficiencies. (Defeatable.)

RFI PROTECTION: All inputs filtered from 100 kHz through 1000 MHz.

TYPE OF MODULATION: Digitally synthesized modulation (DSM).

AUDIO INPUT IMPEDANCE: (left and right) 600 ohms balanced, resistive. Adaptable to other impedances.

AUDIO INPUT LEVEL: (left and right) +10 dBm ± 1 dB for 100% modulation at 400 Hz.

AUDIO FREQUENCY RESPONSE: (left and right) standard 75 microsecond, FCC pre-emphasis curve ± 0.5 dB, 30-15,000 Hz. Selectable: flat, 25 or 50 microsecond pre-emphasis.

INPUT FILTERING: 15 kHz LPF, 50 dB minimum rejection at 19 kHz and above.

OVERSHOOT PROTECTION: Dynamic transient response (DTR) filter.

AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state. Defeatable for test purposes.

HARMONIC DISTORTION: (left or right) 0.4% or less, 30-15,000 Hz.

IMD: 0.4%, 60/7000 Hz, 4:1 ratio.

NOISE: (left or right) 75 dB minimum below 100% modulation. Reference: (400 Hz, 75 microsecond de-emphasis, 1 V RMS output, measured 30 Hz to 15 kHz).

PILOT OSCILLATOR: Crystal controlled.

PILOT STABILITY: 19 kHz ± 1 Hz, 0° to 50° C.

PILOT PHASE: Automatically controlled.

STEREO SEPARATION: 45 dB minimum, 30-15,000 Hz.

DYNAMIC STEREO SEPARATION: 40 dB minimum under normal programming conditions.

CROSSTALK: (main to stereo sub-channel or stereo sub-to-main channel) 45 dB below 90% modulation.

SUB-CARRIER SUPPRESSION: 60 dB minimum below 100% modulation.

76 KHZ SUPPRESSION: 60 dB minimum below 100% modulation.

MODES: Stereo, mono (L+R), mono (L), mono (R). Remoteable.

ORDERING INFORMATION

MS-15R Stereo Generator 994-8140-001

HARRIS CORPORATION Broadcast Products Division
P. O. Box 290, Quincy, Illinois 62301 U.S.A.



HARRIS
COMMUNICATION AND
INFORMATION PROCESSING

MSG-95 Remote SCA Generator

- **Isolated AC coupled input provides line isolation and common mode rejection**
- **DC coupled input for superb slow scan video applications**
- **Built-in low pass filter with selectable cut-off**
- **Selectable pre-emphasis**
- **Selectable or automatic muting minimizes objectionable receiver noise**
- **Front panel LED indicators supply quick operational status**

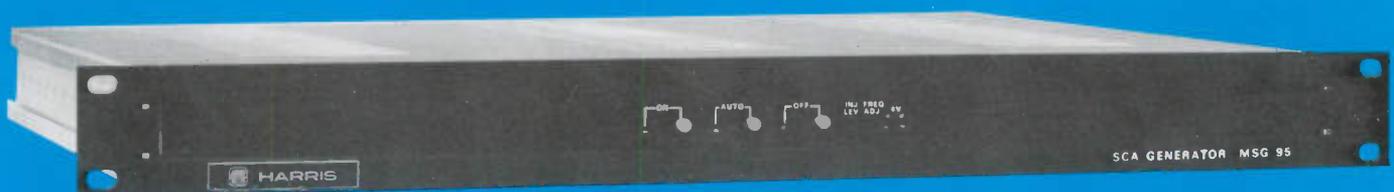
Recognizing the increasing flexibility and demands of SCA service, Harris has developed the MSG-95 remote SCA generator to meet the most demanding requirements. The MSG-95 is designed for use with most exciters or STL links, and is an ideal companion unit to the Harris MSP-95 FM audio composite processing unit.

INPUTS. The MSG-95 is equipped with two input terminals. One is an AC coupled input for general SCA programming needs. The other is a DC coupled input which handles the demands of SCA broadcasters programming slow scan television data.

AUDIO FILTERING. Since SCA programming needs vary considerably, Harris has included a standard low pass filter in the MSG-95. The programmable low pass filter provides the necessary bandwidth protection for stations operating one or two SCA's or stereo programming.

SELECTABLE PRE-EMPHASIS AND MUTING. Again providing the station operator with maximum flexibility to meet operating criteria, the MSG-95 incorporates selectable pre-emphasis of 150, 75, 50 microsecond or flat response. Lengthy bursts of noise in background music or other SCA applications, such as quotation services, can be distracting. To address the wide ranging muting requirements, the MSG-95 muting delay can be adjusted anywhere from 1/2 second to 20 seconds. It is triggered by a drop in audio level, the threshold of which is adjustable from 0 to -30 dBm.

OPERATIONAL CONTROLS/STATUS DISPLAY. At a glance, station personnel can quickly determine the operating mode of the MSG-95 SCA generator. Color-keyed status indicators are positioned adjacent to the "On", "Automatic", and "Off" pushbutton selector switches. Technicians will find the front panel injection level and subcarrier adjust potentiometers convenient. Troubleshooting is also aided by the front panel power supply status LED.



MSG-95 SPECIFICATIONS

FREQUENCY RANGE:	41 kHz or 67 kHz
FREQUENCY STABILITY:	± 500 Hz ($\pm 0.7\%$)
TYPE OF MODULATION:	DCFM
HARMONIC CONTENT OF SUBCARRIER:	less than 1%
FM NOISE:	-55 dB for 5 kHz deviation
MODULATION RESPONSE:	± 1 dB, 150 usec pre-emphasis (30 Hz to 4 kHz)
MODULATION DISTORTION:	less than 1% (measured at 200 Hz and 3.5 kHz)
MODULATION CAPABILITY:	± 5 kHz
PRE-EMPHASIS:	150, 75, 50 usec or flat
SUBCARRIER STATUS:	LED indicators
PROGRAM INPUT IMPEDANCE:	will accept 600 ohm or 150 ohm source
AUDIO INPUT LOW PASS FILTER:	4.5 kHz standard; 3 kHz, 5 kHz, 7.5 kHz selectable
PROGRAM INPUT LEVEL:	+2 dBm; ± 1 dB for 100% modulation
TELEMETRY INPUT CONNECTOR:	BNC female
TELEMETRY INPUT LEVEL:	1 volt for 5 kHz carrier deviation
SUBCARRIER OUTPUT IMPEDANCE:	less than 1000 ohms
SUBCARRIER OUTPUT LEVEL:	100 mV across 10k ohms (adjustable to 300 mV)
MUTING DELAY:	0.5 Sec. to 20 Sec., adjustable
SUBCARRIER OUTPUT CONNECTOR:	BNC female
OPERATING TEMPERATURE RANGE:	-20°C to +45°C
POWER REQUIREMENTS:	105-129 VAC, 50/60 Hz
SIZE:	1 $\frac{3}{4}$ " H \times 19" W \times 16" D
WEIGHT:	6 pounds

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

ORDERING INFORMATION

MSG-95 stand-alone SCA Generator994-8492-001

HARRIS CORPORATION Broadcast Products Division
P. O. Box 4290, Quincy, Illinois 62301 U.S.A. 217/222-8200

MS-15 SPECIFICATIONS

GENERAL

POWER OUTPUT: 3W to 15W, continuously variable.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency (programmable, 50 kHz channel spacing).
RF OUTPUT IMPEDANCE: 50 ohms, open and short circuit proof.
OUTPUT CONNECTION: BNC.
FREQUENCY STABILITY: ± 300 Hz 0° to 50° C, TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation (DCFM).
MODULATION CAPABILITY: ± 100 kHz.
AC INPUT POWER: 100 to 130 VAC or 200 to 260 VAC, 60 or 50 Hz, 150 W.
RF HARMONICS: Suppression meets all FCC requirements for 10 watt educational (53 dB).
POWER SUPPLY RECTIFIERS: Silicon.
ALTITUDE: 15,000 ft.
AMBIENT TEMPERATURE RANGE: 0° C to 50° C (operational to -20° C).
OVERALL CABINET SIZE: 17.7" W (44 cm) x 14"H (35 cm) x 12"D (30 cm). (19" rack mounting standard)
FINISH: Black
AUDIO/CONTROL CONNECTIONS: 2 x 18 pin barrier strips paralleled by 36 pin and socket connector.
MODULATION METER: 10 position, fast rise A/C metering (adjustable to meet FCC ballistics).
MULTIMETER: 10 position, DC metering.

MONAURAL MODE

AUDIO INPUT IMPEDANCE: 600 ohms balanced, resistive, adaptable to other impedances.
INPUT FILTER: Controlled response LPF, defeatable.
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30-15,000 Hz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.2% or less, 30-15,000 Hz.
IMD: 0.2%, 60/7000 Hz, 4:1 ratio.
FM NOISE: 68 dB below 100% modulation (ref. 400 Hz @ ± 75 kHz deviation, measured 30 Hz to 15 kHz with 75 microsecond de-emphasis).
AM NOISE: 70 dB below reference carrier AM modulation 100%, P out = 15 W.

STEREOPHONIC MODE

TYPE OF MODULATION: Digitally synthesized modulation (DSM).
AUDIO INPUT IMPEDANCE: (left and right) 600 ohms balanced, resistive. Adaptable to other impedances.
AUDIO INPUT LEVEL: (left and right) +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: (left and right). Standard 75 microsecond, FCC pre-emphasis curve ± 0.5 dB 30-15,000 Hz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz LPF, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Dynamic transient response (DTR) filter.

AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state. Defeatable for test purposes.
HARMONIC DISTORTION: (left or right). 0.4% or less, 30-15,000 Hz.
IMD: 0.4%, 60/7000 Hz, 4:1 ratio.
FM NOISE: (left or right) 65 dB minimum below 100% modulation. Reference: (400 Hz, 75 microsecond de-emphasis, ± 75 kHz deviation, measured 30 Hz to 15 kHz).
PILOT OSCILLATOR: Crystal controlled.
PILOT STABILITY: 19 kHz ± 1 Hz, 0° to 50° C.
PILOT PHASE: Automatically controlled.
STEREO SEPARATION: 45 dB minimum, 30-15,000 Hz.
DYNAMIC STEREO SEPARATION: 40 dB minimum under normal programming conditions.
CROSSTALK: (main to stereo sub-channel or stereo sub-to-main channel) 45 dB below 90% modulation.
SUB-CARRIER SUPPRESSION: 60 dB below 100% modulation.
76 kHz SUPPRESSION: 60 dB minimum below 100% modulation.
MODES: Stereo, mono (L + R) mono (L), mono (R). Remoteable.

SCA SPECIFICATIONS

MODULATION: Direct FM
FREQUENCY: 41 or 67 kHz programmable, any frequency between 25 and 75 kHz on special order.
FREQUENCY STABILITY: ± 500 Hz.
MODULATION CAPABILITY: ± 7.5 kHz.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled) and 2000 ohms unbalanced (DC coupled, BNC connections on rear panel).
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: 41 kHz and 67 kHz, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable: flat, 50 or 75 microsecond pre-emphasis.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard.
DISTORTION: Less than 1%, 30-4,500 Hz. ± 5 kHz deviation.
FM NOISE: (Main channel not modulated) 55 dB minimum (ref: 100% = ± 5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel); -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA); 50 dB below ± 5 kHz deviation of SCA, with mono or stereo channels modulated by frequencies 30-15,000 Hz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 kHz/67 kHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite. Adjustable.

WIDEBAND MODE

INPUT CONNECTOR: BNC.
INPUT IMPEDANCE: Greater than 5000 ohms resistive, unbalanced.
INPUT LEVEL: 1.0 VRMS nominal for ± 75 kHz deviation.
AMPLITUDE RESPONSE: ± 0.25 dB, 30 Hz to 75 kHz.
PHASE LINEARITY: $\pm 2^\circ$, 30 Hz to 75 kHz.

ORDERING INFORMATION:

MS-15 exciter, for wideband operation, 19 inch rack mounted	994-7950-001
Mono option (add for mono operation)	994-8019-001
DSM stereo generator with DTR (add for stereo operation)	994-8020-001
SCA generator (add for SCA operation, specify 41 or 67 kHz)	994-7992-001

HARRIS CORPORATION Broadcast Products Division
 P. O. Box 4290, Quincy, Illinois 62301 U.S.A.



HARRIS
 COMMUNICATIONS AND
 INFORMATION HANDLING

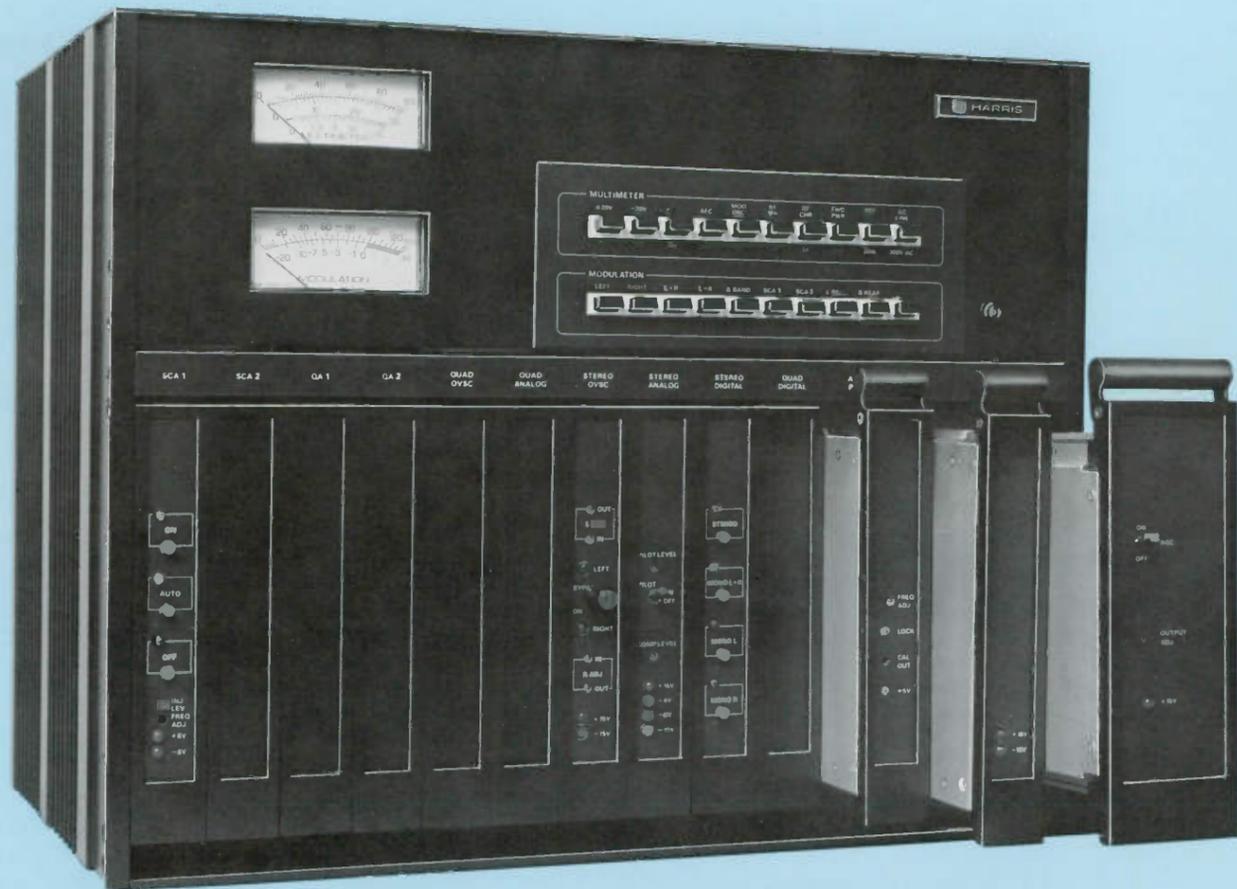
MS-15

Maximum Signal FM Exciter

- Patented DSM Stereo Generator provides separation exceeding accurate measurement capability of most monitors
- DTR filter technique permits 2 to 6 dB loudness increase by eliminating overshoot
- Ultra linear VCO for minimum distortion
- Ovenless TCXO provides maximum stability
- System design virtually eliminates crosstalk into L-R and SCA channels under dynamic and steady state conditions
- Automatic pilot phase control and digital circuitry give long-term high performance
- MS-15--the first significant advance in FM excitors in over a decade



HARRIS' MS-15 — THE MOST ADVANCED FM EXCITER IN THE INDUSTRY



Harris' MS-15 FM Exciter features modular construction for great versatility and ease of maintenance.

A few years ago, Harris introduced PDM to the AM broadcaster and sent hundreds of conventional AM transmitters to standby service.

The MS-15 FM exciter now makes all other FM exciters as obsolete as the plate modulated AM transmitter. Using patented DSM (Digitally Synthesized Modulation) and DTR (Dynamic Transient Response) techniques, the MS-15 offers the quality-minded FM broadcaster the first real alternative to the "me-too" designs, based on decade-old technology, found in other FM exciters.

ULTRA-LINEAR VCO. The unique VCO of the MS-15 features superb linearity not found in conventional modulated oscillator designs. The 0.2% maximum monaural distortion specification is conservative, and typical readings below this limit are not unusual.

Since non-linearities in any direct FM modulated oscillator severely limit stereo performance, the importance of this ultra linearity can easily be seen. Performance is not compromised by complexity. There are no tuning adjustments required of any kind. Only a single jumper is used to select

either the lower or upper half of the FM band!

DIGITAL SYNTHESIZER. The MS-15 uses a 10 MHz TCXO high-stability reference oscillator and programable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison against WWV transmissions on these frequencies. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual state AFC will acquire the VCO over a ± 10 MHz range in

a maximum of 5 seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.

DIGITALLY SYNTHESIZED MODULATION. The DSM stereo generator is a new, patented development that obsoletes switching and balanced modulator forms of stereo generation. While these earlier types of stereo generation suffer from degraded separation at the lower and upper frequency limits (50 Hz and 15 kHz), and/or poor harmonic rejection resulting in degraded crosstalk, DSM has neither of these trade-offs. This results in the cleanest-sounding stereo performance of any FM exciter. Minimum separation is 45 dB from 30 to 15,000 Hz and typically separation will exceed 50 dB over this entire band. Since this exceeds guaranteed accuracy of most modulation monitors, only carefully calibrated test equipment will be able to accurately measure the actual performance of the MS-15.

The high performance characteristics of the DSM generator are easy to maintain year after year. The digital circuitry employed reduces user adjustments to a bare minimum, and these are relatively non-critical in nature. An automatic pilot phase control makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION. A Dynamic Transient Response (DTR) filter was developed by Harris for FM stereo which holds overshoot on any program material to 2% or less. As a result, from 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness.

SCA OPERATION. Up to 2 optional SCA generators may be plugged into the exciter mainframe. A balanced 600 ohm input is provided for normal SCA program audio, and a separate DC coupled wideband input to the generator's direct FM modulator is provided for telemetry or data transmission where DC coupling is required. Crosstalk under dynamic programming conditions, which plagues many SCA generation systems, is virtually inaudible in the MS-15 exciter system.

POWER AMPLIFIER. The power amplifier module is conservatively rated at 15 watts output, and requires no tuning across the entire FM band. A lowpass filter with one tuning adjustment keeps RF harmonics to less than -53 dB. The output is VSWR protected to prevent accidental damage to the PA.

GENERAL. The MS-15 mainframe is

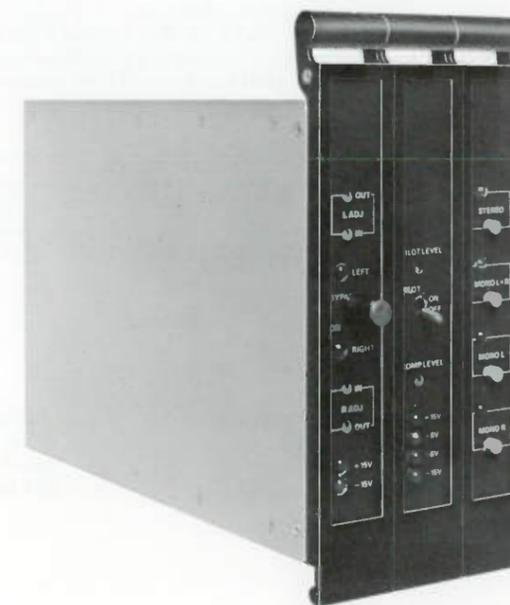
ruggedly constructed from interlocking aluminum extrusions. A positive guidance system permits easy removal and reinsertion of all modules. All modules can be serviced from the front of the exciter using the extender card supplied with the exciter.

Audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic exciter audio response is wideband and flat, and can be used, without interface, directly with a studio-transmitter link.

The exciter is configured to accept a plug-in quadrasonic FM generator and provides metering of Left and Right rear audio inputs. All of the five competing quadrasonic systems currently under consideration by the FCC can be accommodated by the MS-15.

Status LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 20 functions. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator.



The Harris DSM stereo generator, with digitally synthesized modulation, provides 45 dB stereo separation minimum, 30-15,000 Hz, and overshoot no greater than 2%.



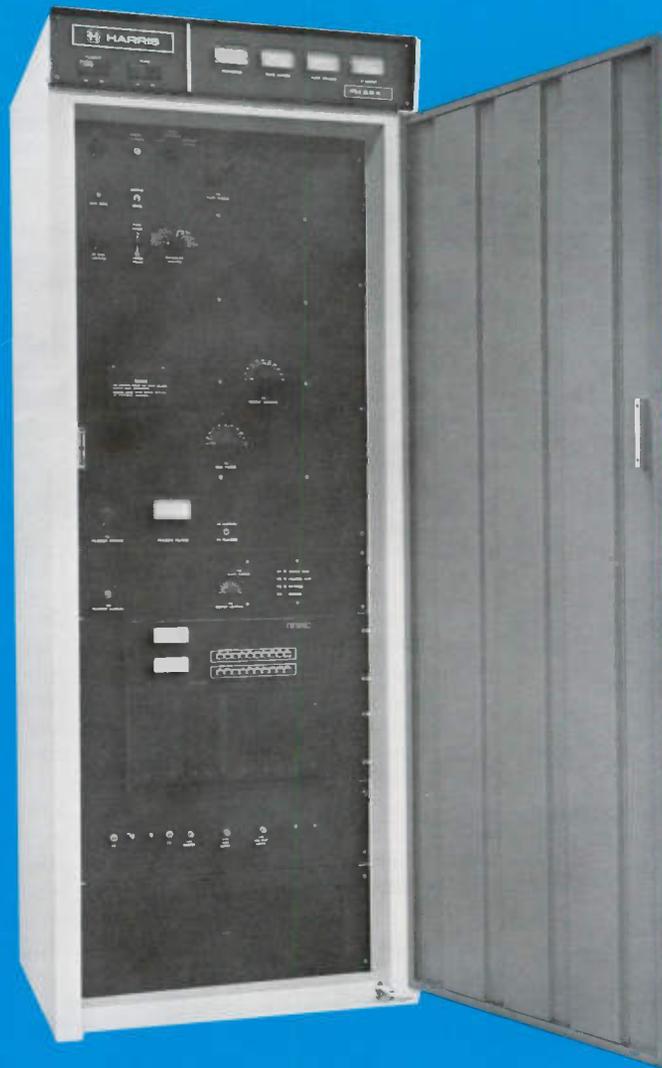
HARRIS

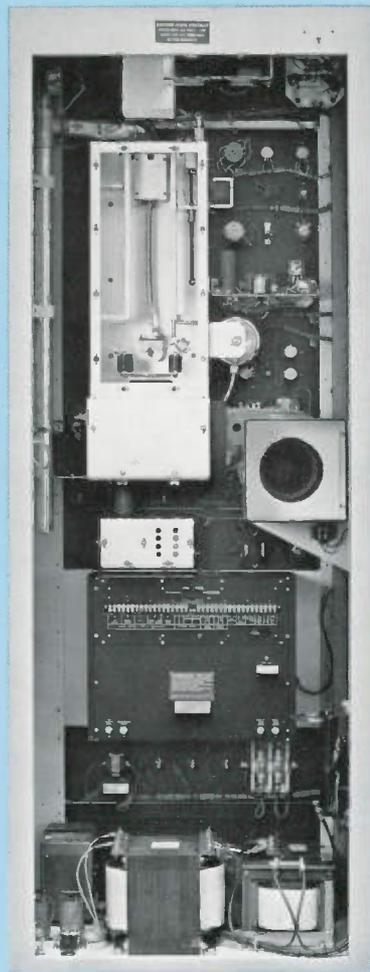
FM-2.5K

2.5-Kilowatt
FM Broadcast
Transmitter

- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Digitally Synthesized Modulation stereo generator provides 50 dB separation, offering new stereo realism
- Dynamic Transient Response (DTR*) stereo generator filter maximizes modulation level without overmodulating
- Single phase power supply eliminates the need for costly three phase AC service
- Stable, quarter wave PA cavity minimizes tuning adjustments
- Extensive metering and status displays for ease of operation and service
- Standard filament voltage regulator increases tube life

*Patented





FM-2.5K, rear view, door off.

The FM-2.5K employs Harris' exclusive, advanced-design MX-15 solid state exciter, with Digitally Synthesized Modulation (DSM), to provide the very finest stereo signal available. Technical specifications are exceptional compared to other 2.5 kilowatt FM transmitters on the market. And DSM with overshoot compensation allows a 2 to 6 dB increase in loudness with no degradation of audio quality!

The transmitter consumes only 4.8 kilowatts at full output—and will provide 3000 watts effective radiated power in both horizontal and vertical planes when used with a Harris 3-bay FML-3E Circularly Polarized FM antenna. This assumes a coaxial cable efficiency of 82%.

The FM-2.5K uses single phase power...in areas where this is the only type of power available, no additional lines are required.

Two tubes are employed in the FM-2.5K—the 4X150A intermediate power amplifier, and the 5CX1500A single-ended final power amplifier.

PLUG-IN MONO, STEREO AND SCA GENERATORS

The FM-2.5K may be equipped for mono or

stereo operation, with or without SCA. The design versatility of the exciter allows you to order for mono operation originally, then add stereo and/or SCA at a later date by plugging the appropriate module(s) into the exciter. Since the SCA generators have spectrally pure filtered outputs, 41 and 67 kHz SCA channels may be operated simultaneously while in the mono mode without harmonic interference.

STABLE, EASY OUTPUT TUNING

Plate tuning of the final amplifier is stable and easily adjusted. The plate circuit is a shorted, one-quarter wavelength configuration, with the plate line operated at DC ground potential. Coarse plate tuning is pre-set for the operating frequency on the plate line. Fine adjustment is made with the plate tuning knob on the front panel. Amplifier loading is changed by a variable output loading control.

AUTOMATIC RECYCLING

The recycle circuitry in the FM-2.5K is adjustable, self-clearing and uncomplicated. Should a momentary overload occur, the transmitter will recycle automatically. If the overload occurs in excess of the number of times pre-set, the transmitter will remain

off the air until it is reset, either manually or by remote control.

POWER OUTPUT CONTROL

The transmitter has a built-in motor-operated rheostat connected to the screen supply for adjusting the power output. A built-in reflectometer with a VSWR power meter makes adjustments of the power output easy and accurate.

REMOTE CONTROL

The FM-2.5K features built-in remote metering for the plate voltage, plate current and power output. This FM-2.5K feature simplifies remote control interface.

PUSHBUTTON OPERATION

Manual operation of the transmitter is simple. On-Off functions are controlled by lighted, dual pushbuttons at the top left of the cabinet. They are clearly marked Filament On and Off, Plate On and Off. After the filaments of the tubes are turned on, a time-delay relay allows the cathodes to reach operating temperatures before the plate power can be turned on.

COMPLETE TESTING

Environmental tests, in conditions surpassing those of any location a transmitter is likely to encounter, have been imposed on the FM-2.5K. The transmitter is capable of operating at altitudes to 7500 feet, in an ambient temperature range of -20° to $+45^{\circ}\text{C}$.

In addition, your FM-2.5K is fully tuned and operationally tested on your frequency before shipment.

HARMONIC FILTER STANDARD

Supplied with a Harris-designed harmonic filter, the transmitter fully meets FCC requirements for spurious radiation. All filtering is mounted inside the transmitter cabinet and provides rapid cut-off of second and higher order harmonics.

QUALITY COMPONENTS

Every transmitter component is conservatively operated and chosen to give optimum performance in continuous duty service. In Harris' MX-15 exciter, only performance-proven solid-state devices and precision temperature compensated components are used throughout.

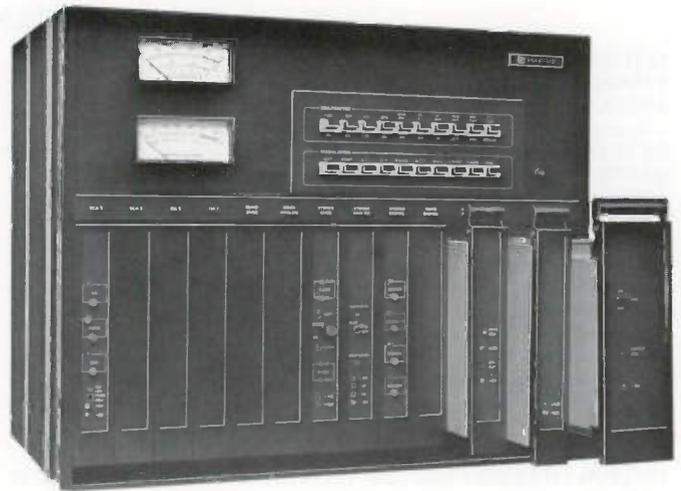
STYLING

Handsomely yet functionally styled, the transmitter cabinet is finished in white and blue, with a black meter panel. The FM-2.5K is completely self-contained in one cabinet, and simplicity of design allows easy access to all components.

TYPE ACCEPTANCE

The FM-2.5K is FCC type accepted for mono or stereo broadcasting in the 87.5 to 108 MHz band.

Harris MX-15 Exciter . . . new levels of excellence in FM audio performance



Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion through the FM-2.5K is an exceptionally low .05%, with all CCIF Intermodulation distortion products down at least 75 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ± 100 kHz.

Equally impressive is the FM-2.5K/MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the probability of ground loops and other system interface problems.

DIGITAL SYNTHESIZER

The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct frequency comparison against WWV transmissions. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ± 10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.

DIGITALLY SYNTHESIZED MODULATION

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Stereo separation typically exceeds 50 dB from 30 to 15,000 Hz.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION

A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION

Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation continuously. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations

programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER

The MX-15 power amplifier module is solid-state, conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL EXCITER FEATURES

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.

FM-2.5K TRANSMITTER SPECIFICATIONS

GENERAL

POWER OUTPUT: 800 W to 2.5 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 1 $\frac{1}{8}$ " EIA flange.
FREQUENCY STABILITY: +300 Hz 0° to 45°C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation (DCFM).
MODULATION CAPABILITY: \pm 100 kHz.
AC INPUT POWER: 197/250 V, 60 or 50 Hz, single phase, two wire. Power consumption: 4800 watts (approx.). 115/230 V, 60 or 50 Hz, 150 watts for MX-15.
RF HARMONICS: Suppression meets all FCC requirements.
POWER SUPPLY RECTIFIERS: Silicon.
ALTITUDE: 7,500 feet.
AMBIENT TEMPERATURE RANGE: -20°C to +45°C.
MAXIMUM VSWR: 1.7 to 1.
OVERALL CABINET SIZE: 29" W (74 cm) \times 78" H (198 cm) \times 33" D (84 cm).
FRONT DOOR SWING: 29" (74 cm).
FINISH: White, blue and black.
WEIGHT & CUBAGE: Export: 1350 lbs. (612 kg). Domestic: 1100 lbs. (499 kg). 104 cu. ft. (2.9 cu. m).

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for \pm 75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ \pm 75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .05% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 75 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: \pm 0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 50 dB below reference carrier AM modulation 100% output power.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm \pm 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve \pm 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.15%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ \pm 75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: +10 dBm, \pm 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve \pm 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 75 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -50 dB.
NON-LINEAR CROSSTALK: -60 dB.
76 kHz SUPPRESSION: -68 dB.
38 kHz SUPPRESSION: -73 dB.
FM NOISE: (Left or right) 72 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, \pm 75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz \pm 1 Hz 0° to 50°C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—remoteable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 41 or 67 kHz programmable, any frequency between 25 and 75 kHz on special order.
FREQUENCY STABILITY: \pm 500 Hz.
MODULATION CAPABILITY: \pm 7.5 kHz.
AUDIO FREQUENCY RESPONSE: 41 kHz and 67 kHz AC coupled input, 150 microsecond pre-emphasis \pm 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz \pm 0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, \pm 1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz \pm 5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = \pm 5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 55 dB below \pm 5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 kHz/67 kHz) -50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Specifications subject to change without notice.

ORDERING INFORMATION

FM-2.5K 2500 watt FM broadcast transmitter with MX-15 exciter, for wideband operation, 60 Hz	994-8047-001
As above, except 50 Hz	994-8047-003
100% spare tube kit	990-0587-001
Mono generator (add for mono operation)	994-8019-001
DSM stereo generator with DTR (add for stereo operation)	994-8020-001
SCA generator (add for SCA operation, specify 41 or 67 kHz)	994-7992-001

HARRIS CORPORATION **BROADCAST DIVISION**
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200



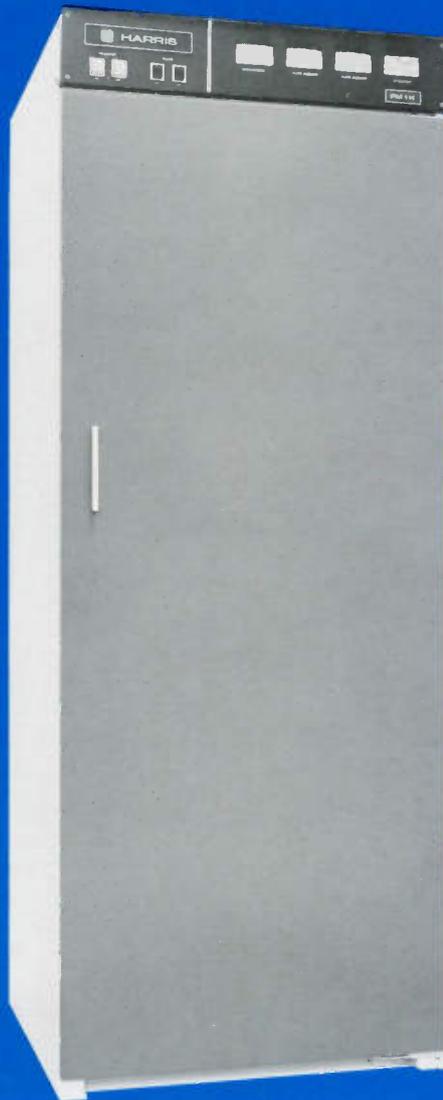
HARRIS

FM-1K

1-Kilowatt
FM Broadcast
Transmitter

- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Digitally Synthesized Modulation stereo generator provides 60 dB midband separation for increased stereo realism
- Dynamic Transient Response (DTR*) stereo generator filter maximizes modulation level without overshoot
- Single phase power supply eliminates the need for costly three phase AC service
- Stable quarter wave PA cavity minimizes tuning adjustments
- Extensive metering and status displays for ease of operation and service

*Patented



Shown with optional
front door.



The FM-1K employs Harris' advanced-design MX-15 solid-state exciter to provide the cleanest and the loudest FM signal of any one-kilowatt FM transmitter available today. The DSM (Digitally Synthesized Modulation) stereo generator allows the transmitter to provide stereo separation of 50 dB minimum, 30-15,000 Hz—while the DTR (Dynamic Transient Response) filter permits a 2 to 6 dB increase in loudness, with no degradation of audio quality, by limiting overshoot to 2% or less.

ONE TUBE DESIGN

Just one tube—a 4CX1000A tetrode—is all that is needed to supply 1000 watts output in the FM-1K. Driven directly by the MX-15 exciter, the 4CX1000A serves as the power amplifier and is operated well within its ratings for long tube life.

PLUG-IN MONO, STEREO AND SCA GENERATORS

The FM-1K may be equipped for mono or stereo operation, with or without SCA. The design versatility of the exciter allows you to order for mono operation originally, then add stereo and/or SCA at a later date

by plugging the appropriate module(s) into the exciter.

STABLE, EASY OUTPUT TUNING

Plate tuning of the final amplifier is stable and easily adjusted. The plate circuit is a shorted one-quarter wavelength configuration, with the plate-line operated at DC ground potential. Coarse plate tuning is preset for the operating frequency on the quarter-wave tank circuit. Fine adjustment is made with the plate tuning knob on the front panel. Amplifier loading is changed by a variable output loading capacitor.

POWER OUTPUT CONTROL

The transmitter's output loading control is motor-driven for smooth power adjustments, either locally or from a remote point. This feature allows the screen voltage of the 4CX1000A to be Zener-diode regulated for exceptional operating stability and tube life.

HARMONIC FILTERS STANDARD

Supplied with a Harris-designed multi-section harmonic filter, the transmitter

fully meets FCC requirements for spurious radiation. The second harmonic shorting stub is mounted inside the transmitter cabinet, leaving the easy-to-install low-pass in-line filter as the only external component.

AUTOMATIC RECYCLING

In case of momentary overload, the transmitter recycles automatically. Should the overload reoccur in excess of the desired number of times preset in the transmitter, the FM-1K will then remain off the air until it is reset, either locally or by remote control.

REMOTE CONTROL

All necessary operating functions can be remote controlled. No additional equipment is required to adapt a Harris remote control system to the transmitter. Connections are easily and simply made at a terminal strip in the cabinet.

TESTING

Environmental tests, in conditions surpassing those of any location a transmitter is likely to encounter, have been imposed on the FM-1K. The transmitter is capable of operating at altitudes up to 10,000 feet (3000 meters), in an ambient temperature range of -20° to $+45^{\circ}\text{C}$.

In addition, your FM-1K is fully tuned and operationally tested on your frequency before shipment.

FULL METERING

Six meters, including four large, front-panel meters, provide full monitoring of the transmitter's operating parameters. Included is a power indicator that permits direct reading of both power output and standing wave ratio.

GENERAL

There are many other operational and convenience features incorporated into the FM-1K. These include:

Pushbutton Operation—On-off functions are controlled by lighted pushbuttons at the top left of the transmitter. These are clearly marked "Filament On-Off", "Plate On-Off".

High-Capacity Blower—backed up by a precision air-pressure switch, gives complete protection to the final amplifier tube.

Straightforward Design—allows easy accessibility to all components.

Handsome Styling—the transmitter cabinet is attractively yet functionally styled, and features a white and blue finish, with a black meter panel.

FCC Type Acceptance—the FM-1K is FCC type accepted for mono or stereo broadcasting in the 87.5 to 108 MHz FM band.

Harris MX-15 Exciter . . . new levels of excellence in FM audio performance

Continuing in its trend-setting tradition, Harris has incorporated state-of-the-art refinements in exciter technology to introduce the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter provides the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low 0.1%, with all CCIF Intermodulation distortion products down at least 77 dB. This important criterion shows the quality of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ± 100 kHz.

Equally impressive is the MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the exciter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise provides your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

DIGITAL SYNTHESIZER

The MX-15 uses a highly stable 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system.

The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison against WWV transmissions on these frequencies. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ± 10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.



DIGITALLY SYNTHESIZED MODULATION

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike older technology still on the market, that suffers from degraded separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk, Harris' DSM technique has neither of these shortcomings. DSM stereo generation is essentially transparent to the program material. Separation is specified at 50 dB (typically 60 dB at mid-frequencies) over the 30-15,000 Hz range.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION

A patented Dynamic Transient Response (DTR) filter, developed by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION

Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation all the time. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation head room when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that

minimizes distortion to slow-scan television or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER

The MX-15 power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL BENEFITS

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.

FM-1K TRANSMITTER SPECIFICATIONS

GENERAL

POWER OUTPUT: One kilowatt.
FREQUENCY STABILITY: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 1 $\frac{5}{8}$ " EIA flange.
FREQUENCY STABILITY: ± 300 Hz 0° to 45°C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation (DCFM).
MODULATION CAPABILITY: ± 100 kHz.
AC INPUT POWER: 208/240 V, 60 or 50 Hz, single phase, three wire. Power consumption: 2100 watts (approx.). 115/230 V, 60 or 50 Hz, 150 watts for MX-15.
RF HARMONICS: Suppression meets all FCC requirements.
POWER SUPPLY RECTIFIERS: Silicon.
ALTITUDE: 10,000 feet (3000 meters).
AMBIENT TEMPERATURE RANGE: -20°C to +45°C.
MAXIMUM VSWR: 1.7 to 1.
OVERALL CABINET SIZE: 29" W (74 cm) \times 78" H (198 cm) \times 33" D (84 cm).
FRONT DOOR SWING: 29" (74 cm).
FINISH: White, blue and black.
WEIGHT & CUBAGE: Export: 1300 lbs. (590 kg). Domestic: 1050 lbs. (476 kg). 104 cu. ft. (2.9 cu. m).

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ± 75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .15%.
COMPOSITE INTERMODULATION DISTORTION: 0.1% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 77 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 50 dB below reference carrier AM modulation 100% output power: 15 watts.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 80 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -50 dB.
NON-LINEAR CROSSTALK: -60 dB.
76 kHz SUPPRESSION: -68 dB.
38 kHz SUPPRESSION: -73 dB.
FM NOISE: (Left or right) -70 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ± 1 Hz 0° to 50°C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—remoteable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 67 or 92 kHz programmable, any frequency between 25 and 92 kHz on special order.
FREQUENCY STABILITY: ± 500 Hz.
MODULATION CAPABILITY: ± 7.5 kHz.
AUDIO FREQUENCY RESPONSE: 67 kHz and 92 kHz AC coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ± 0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ± 5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = +5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ± 5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (67 kHz/92 kHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).
CARRIER MUTE DECAY: Greater than 30 milliseconds.

Specifications subject to change without notice.

ORDERING INFORMATION

FM-1K, 1 kW FM transmitter with MX-15 exciter, for wideband operation, 50/60 Hz.	994-8046-003
Mono generator (add for mono operation)	994-8019-001
DSM stereo generator with DTR (add for stereo operation)	994-8020-001
SCA generator (add for SCA operation, specify 67 or 92 kHz)	994-7992-002

HARRIS CORPORATION BROADCAST GROUP
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

Harris MX-15 Exciter . . . new levels of excellence in FM audio performance



Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion through the FM-3.5K is an exceptionally low .08%, with all CCIF Intermodulation distortion products down at least 80 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of 133%.

Equally impressive is the FM-3.5K/MX-15's —80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the probability of ground loops and other system interface problems.

DIGITAL SYNTHESIZER

The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct frequency comparison against WWV transmissions. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ±10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.

DIGITALLY SYNTHESIZED MODULATION

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Stereo separation typically exceeds 50 dB from 30 to 15,000 Hz.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION

A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION

Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation continuously. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations

programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER

The MX-15 power amplifier module is solid-state, conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL BENEFITS

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.

FM-3.5K TRANSMITTER SPECIFICATIONS

GENERAL

POWER OUTPUT: 800 Watts to 3800 Watts.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 1½" EIA flange.
FREQUENCY STABILITY: ±300 Hz 0° to 45°C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation (DCFM).
MODULATION CAPABILITY: 133%.
AC INPUT POWER: 197/250 V, 60 or 50 Hz, single phase, two wire. Power consumption: 7000 watts (approx.). 60 or 50 Hz, 150 watts for MX-15.
RF HARMONICS: Suppression meets all FCC requirements.
ALTITUDE: 10,000 ft./60 Hz, 7500 ft./50 Hz.
AMBIENT TEMPERATURE RANGE: -20°C to +45°C.
MAXIMUM VSWR: 2.0:1.
OVERALL CABINET SIZE: 33" W (84 cm) × 72" H (182 cm) × 34" D (99 cm).
FINISH: White, blue and black.
WEIGHT & CUBAGE: Export: 46.7 cu. ft. (1,322 cu. m); Weight 880 lbs. domestic (400 Kg); 980 lbs. export (445 Kg).

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ±0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 55 dB below reference carrier AM modulation 100% output power.
SYNCHRONOUS AM SIGNAL TO NOISE: -50 dB.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: .045%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).
STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

Specifications subject to change without notice.

ORDERING INFORMATION

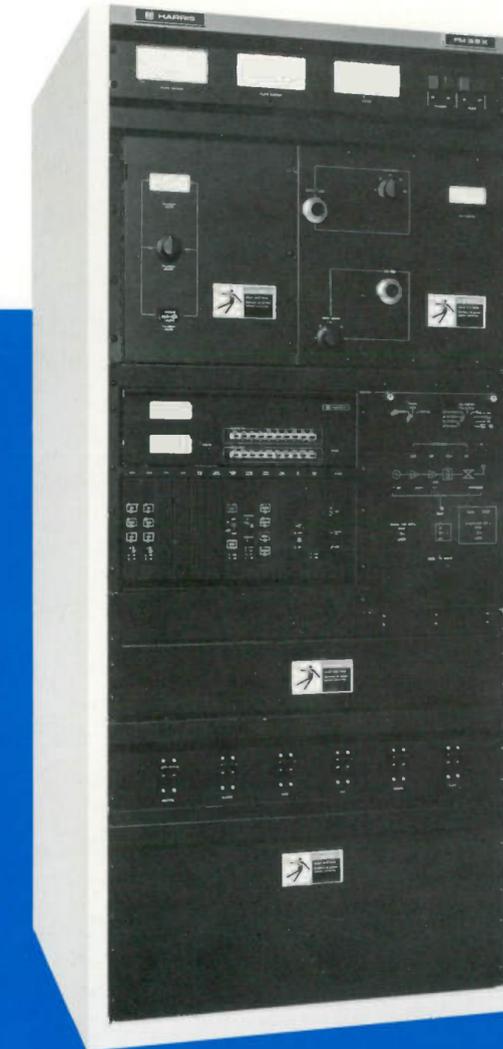
FM-3.5K, 3500 Watt FM Broadcast Transmitter with MX-15 Exciter for wideband operation, 197 to 250 VAC, Single Phase 50 or 60 Hz (specify)	994-8766-001
Options	
Constant Voltage Filament Regulator Transformer	472-0586-000 for 60 Hz 472-1244-000 for 50 Hz
Spare 4CX3500A PA Tube	374-0169-000
Mono Generator (Add For Mono Operation)	994-8019-001
Harris DSM Stereo Generator (For Stereo Operation)	994-8020-001
Harris SCA Generator (67 or 92 kHz Operation)	994-7992-002

HARRIS CORPORATION BROADCAST TRANSMISSION DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200



FM-3.5K

3.5-kilowatt FM broadcast transmitter



Harris FM-3.5K...even more than you bargained for in a high-performance FM transmitter

- 800 to 3800 watt output power range
- MX-15 exciter for minimum distortion, maximum signal clarity
- Single phase AC eliminates need for costly 3-phase service
- Automatic power control minimizes operator adjustment
- Automatic VSWR foldback helps keep transmitter on air during antenna icing conditions
- Front panel block diagram display helps isolate problems, minimize down time
- Full remote control interface included



When considering 3.5 kW FM transmitters, local service FM broadcasters in general have two major requirements—long term reliability and audio performance. Without question the Harris FM-3.5K meets these crucial requirements and more.

POWER TO MEET YOUR TRANSMISSION SYSTEM'S REQUIREMENT

The Harris FM-3.5K can provide any output power from 800 to 3800 watts. This full range allows you to select the most effective antenna size, tower height and transmission line combination to meet your coverage requirements.

The FM-3.5K consumes only 7 kW of power at 3.5 kW output. Based on an 18 hour broadcast day and a typical power charge of 8¢ per kilowatt hour, this represents an operating cost of only \$10.08 per day.

Even at full 3.5 kW output, the FM-3.5K requires only single phase AC power. Unlike other transmitters in this power range, there is no need to bring in costly 3-phase AC service to your facility.

HIGHLY RELIABLE, LONG LIFE POWER AMPLIFIER DESIGN

The Harris FM-3.5K utilizes a modern

power amplifier chain that provides you with many years of dependable service.

The high performance Harris MX-15 FM exciter begins the RF chain by delivering 15 watts of power.

The MX-15 is followed by an all solid state 150 watt driver stage which has been specifically designed not to degrade the MX-15's high quality signal. The driver will survive any load condition from opens to shorts. Typically required to produce only 75 watts of drive, the amplifier loafs at one-half its power capability. Should servicing ever be

required, the driver is housed in a modular enclosure which can be quickly removed.

The long life 4CX3500A power tetrode is especially designed for broadcast service. Harris engineers have designed the PA to dissipate only 33% of the tube's rated anode capability for long tube life and reliable operation.

EMERGENCY PA PATCHING CAPABILITY

Station engineers will appreciate the 50 ohm interface used between the exciter, driver, and power amplifier. This Harris feature permits the exciter to be routed directly into the PA, or the IPA to be routed directly into the antenna. This flexibility allows you to remain on the air at reduced power should a stage fail. In most instances,

reduced power operation will provide you with a surprisingly good signal over your main coverage area.

BANDPASS OUTPUT NETWORK

Broadcast transmitter locations are growing more congested with other radio services. Therefore, Harris has incorporated a unique bandpass output network into the FM-3.5K to reduce signal interference from other RF services.

TRANSMITTER CONTROL AND STATUS AT A GLANCE

The FM-3.5K's control and status section features a straightforward design that controls and monitors all vital areas to insure top performance. Operators and engineers can determine at a glance the status of the

FM-3.5K from its front panel signal path block diagram display. Bright LED indicators signal circuit status in each major functional stage. These indicators have fault memory in case of power failure.

Station engineers will appreciate the 9-position multimeter that monitors low level stages. A separate true RMS filament voltmeter and front panel control make filament voltage metering and adjustment convenient to optimize tube life.

Automatic Power Control. With a Harris FM-3.5K in service, the need for operator output power adjustments is practically eliminated as its precision automatic power control unit maintains output power to within +5%. Operators will no longer be surprised to find that the station has been operating above or below power for some time due to line voltage fluctuations. The Harris FM-3.5K eliminates this operator concern and constantly maintains authorized power.

Automatic VSWR Foldback. In certain areas, heavy icing conditions occur frequently, often causing antenna VSWR to rise and transmitters to shut down. Recognizing this, Harris engineers have included an automatic VSWR foldback circuit that permits continued safe operation under high VSWR conditions at reduced power. Since this FM-3.5K feature is automatic, there is no need to call the station's engineer to adjust controls or retap transformers. When the VSWR condition clears, normal high power operation is automatically restored.

AC Restart. As momentary power outages are common, the FM-3.5K is equipped with automatic AC restart to immediately return the transmitter to service when power is restored.

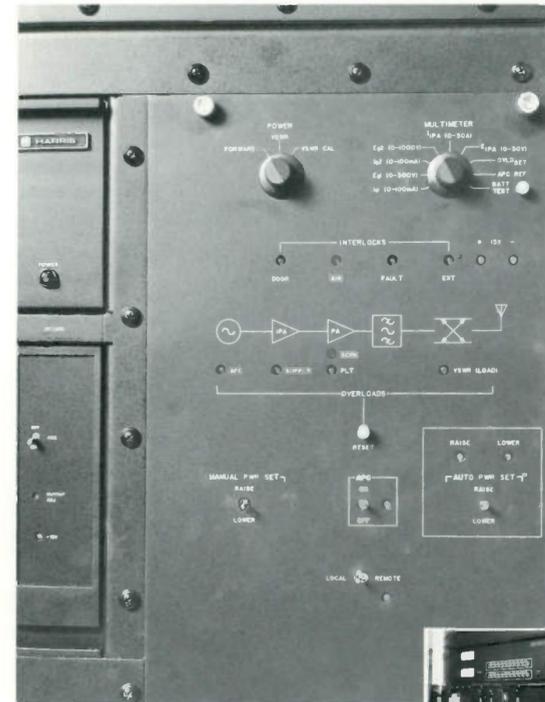
REMOTE CONTROL INTERFACE INCLUDED

Unlike other FM transmitters, remote control interface is an integral part of the FM-3.5K—not an expensive option. Momentary contact closure, suitable for all popular remote control systems, is all that is required for the typical on/off, raise/lower functions. Analog meter samples, along with status lights, are also available for remote control interface.

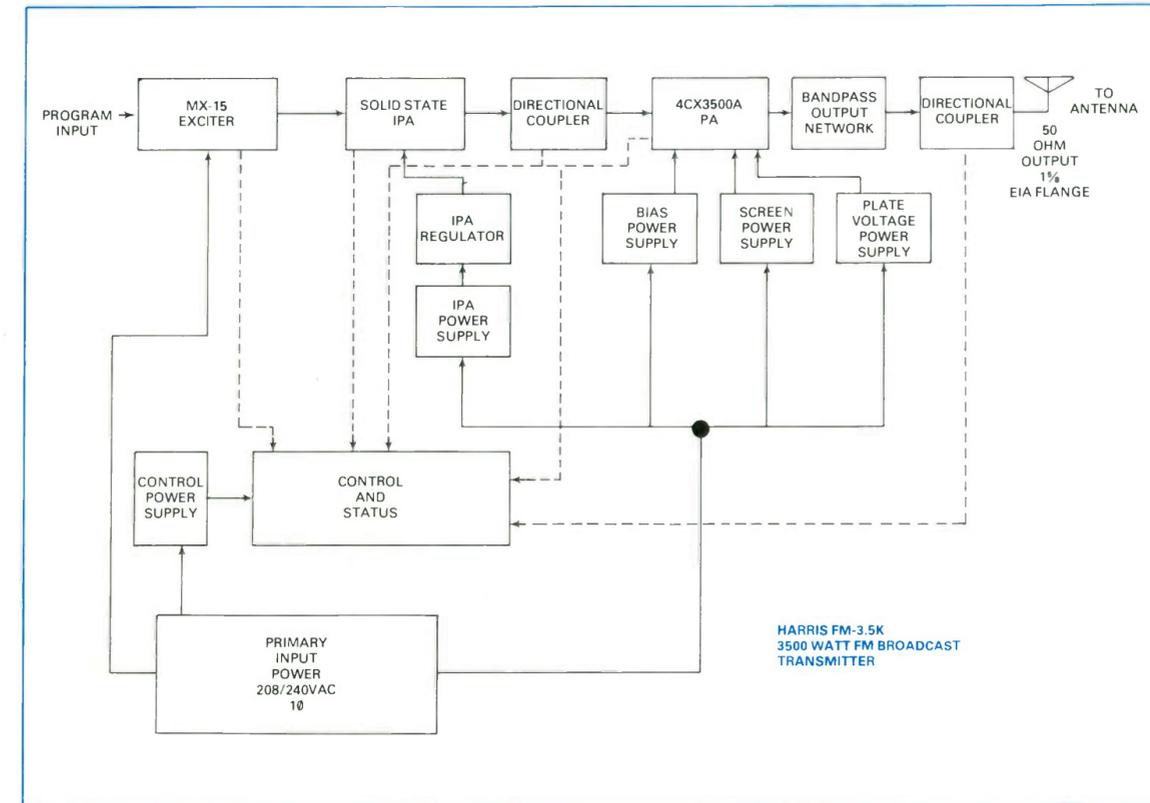
ATTENTION TO DETAILS

Quality details have been addressed on every FM-3.5K to minimize potential problems. For example, all plug-in PC boards have gold plated edge connectors to insure the highest contact reliability. All fabricated metal parts are individually treated to protect them from corrosive elements.

These are just a few examples of Harris quality standards at work for you now and for many years to come.



Operators and engineers can determine at a glance the status of the FM-3.5K from its front signal path block diagram. Bright LED indicators quickly isolate a problem stage. Panel swings down (inset) for immediate component accessibility.



HARRIS FM-3.5K 3500 WATT FM BROADCAST TRANSMITTER

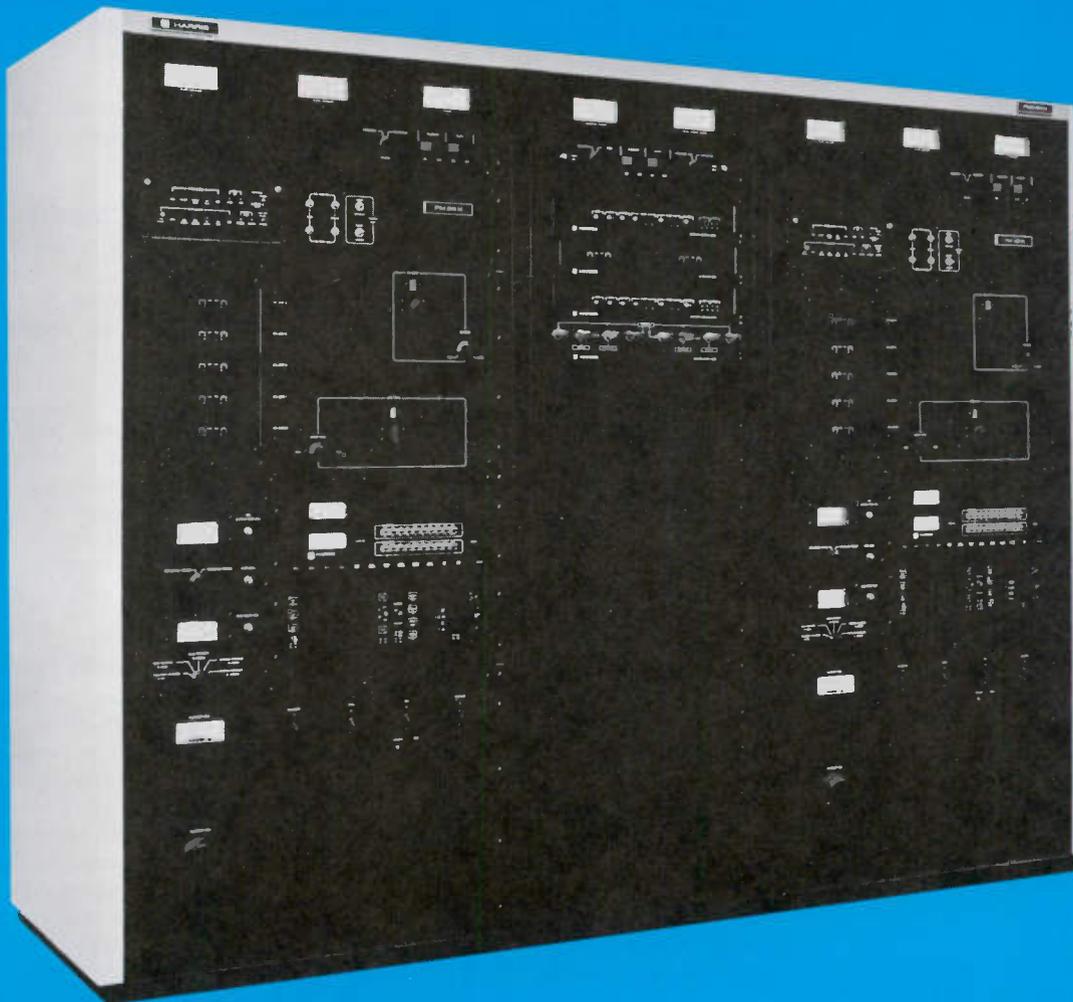


HARRIS
COMMUNICATION AND
INFORMATION PROCESSING

FMD-50K

50-Kilowatt
Dual FM
Broadcast
Transmitter

- Combines two 25-kilowatt amplifiers for highest on-air reliability
- Only two low stress PA tubes, yielding low operating cost and long tube life
- Wide RF bandwidth for maximum stereo and SCA performance
- Solid-state control logic and automatic power control minimize adjustments
- Featuring the superior MS-15 maximum signal FM exciter
- DSM stereo generator typically yields 50 dB separation for increased stereo realism
- DTR overshoot filter maximizes modulator level



FMD-50K... dual configuration for co



The FMD-50K dual 50-kilowatt transmitter offers real protection against off-air time through redundancy, and through extensive use of solid-state circuitry. Only two tubes are employed in the entire FMD-50K... high-gain, highly efficient 8990 tetrodes used as the final power amplifiers. The 8990 uses a wavy fin radiator which provides exceptional cooling at reduced air requirements, for quiet operation. The quarter-wave PA cavity design eliminates troublesome sliding contacts for tuning, and assures wide RF bandwidth. This results in a signal path that is transparent to the MS-15 exciter.

The **basic** FMD-50K transmitter consists of two 25-kilowatt amplifiers, and a center control cabinet. It provides redundancy in all areas except the exciters. In case emergency operation is required, you stay on the air at one-quarter normal power output. An even higher level of redundancy is achieved in the **complete** FMD-50K through an optional arrangement of switches, sensors and circuits that make the FMD-50K totally redundant from audio input to RF output.

The FMD-50K with the RF output switching option provides the capability of automatically switching either transmitter directly to the antenna, thus providing one-half normal operating power in the event of a transmitter malfunction.

With the addition of the automatic exciter switching option, automatic backup exciter protection is provided. Also, an optional RF input patch panel is available to connect either exciter directly to either transmitter by bypassing all of the automatic exciter switching equipment.

SOLID-STATE IPA'S

The redundancy of the dual FMD-50K is heightened when the IPA in each 25-kilowatt amplifier is considered. The IPA stages are multiple solid-state amplifiers combined in such a manner that failure of one amplifier stage will not cause a total loss of IPA RF power. The IPA solid-state modules in the PA are identical to those used in the booster amplifier for the MS-15. The wide use of solid-state RF power circuits means that the FMD-50K uses only two tubes!

LOW OPERATING COST

With today's mounting energy costs, transmitter efficiency must be a major consideration in any purchase. 77% efficiency in the final power amplifiers, high efficiency in all amplifier circuits, and conservatively rated components result in comparatively low power consumption and low operating stress on heat generating components in the FMD-50K. This adds up to very impressive savings in operating and maintenance costs.

FINEST STEREO PERFORMANCE

Featuring the advanced-design MS-15 exciter, Harris' FMD-50K provides the cleanest and the loudest stereo signal of any 50-kilowatt FM transmitter available today. The DSM (Digitally Synthesized Modulation) stereo generator allows the transmitter to provide stereo separation of 40 dB minimum (50 dB typical), 30-15,000 Hz—while the DTR (Dynamic Transient Response) filter permits a 2 to 6 dB increase in loudness, with no degradation of audio quality, by limiting overshoot to 2% or less.

The FMD-50K may be equipped for mono or stereo operation, with or without SCA.

The design versatility of the MS-15 exciter allows you to order mono operation originally, then add stereo and/or SCA at a later date by plugging the appropriate module(s) into the exciter. The FMD-50K is equipped for wideband composite input in its standard configuration.

AUTOMATIC POWER CONTROL

The FMD-50K automatically monitors power output, and maintains the output at the desired level. This standard feature insures against out-of-tolerance power conditions. Furthermore, the power set point can be remotely adjusted independently of the limit points to allow operator control of power output. During maintenance periods, the automatic power control may be switched off.

VSWR PROTECTION

VSWR protection is mandatory in any high-power transmitter—therefore, Harris has incorporated this as a standard feature in the FMD-50K. A high VSWR condition will cause the transmitter to recycle... if three overloads occur within a given time period, the transmitter will shut down until manually restarted. The transmitter may also be programmed for single VSWR overload shutdown.

CONTROL CIRCUITRY

The FMD-50K is controlled by solid-state logic circuitry. The logic circuitry not only controls basic On/Off functions, but also monitors critical stages for overload conditions. Should an overload occur, the transmitter will recycle automatically.

The control logic used in the FMD-50K interfaces directly with most remote control systems, eliminating the need for an additional remote control interface. The control signals are momentary low current contacts. The transmitter output parameters are buffered, and all status indicators can be removed.

METERING AND VISUAL AIDS

Major functions, including combined output power, VSWR and reject load power are displayed on easy-to-read 4-inch meters in the center cabinet. Complete monitoring of operating functions of the individual 25-kilowatt amplifiers are also displayed. Low-level parameters of each amplifier are displayed on a multimeter, and IPA RF output and reflected power are indicated on another meter. Filament voltage is measured by a true RMS circuit.

The FMD-50K provides a variety of indicators as troubleshooting aids and quick

complete redundancy... only two tubes

references. These include illuminated On/Off pushbuttons and numerous LED status indicators.

HV POWER SUPPLIES

The two high voltage power supplies are housed in separate cabinets, and provide the plate and screen voltage. The conservatively-rated three-phase plate supplies use silicon rectifiers with AC line transient protection.

COMPACT SIZE

The trim FMD-50K cabinet configuration measures only 90.2" wide, 72" high and

30.5" deep. Additionally, the HV power supplies may be located in any convenient spots remote from the PA cabinets.

GENERAL

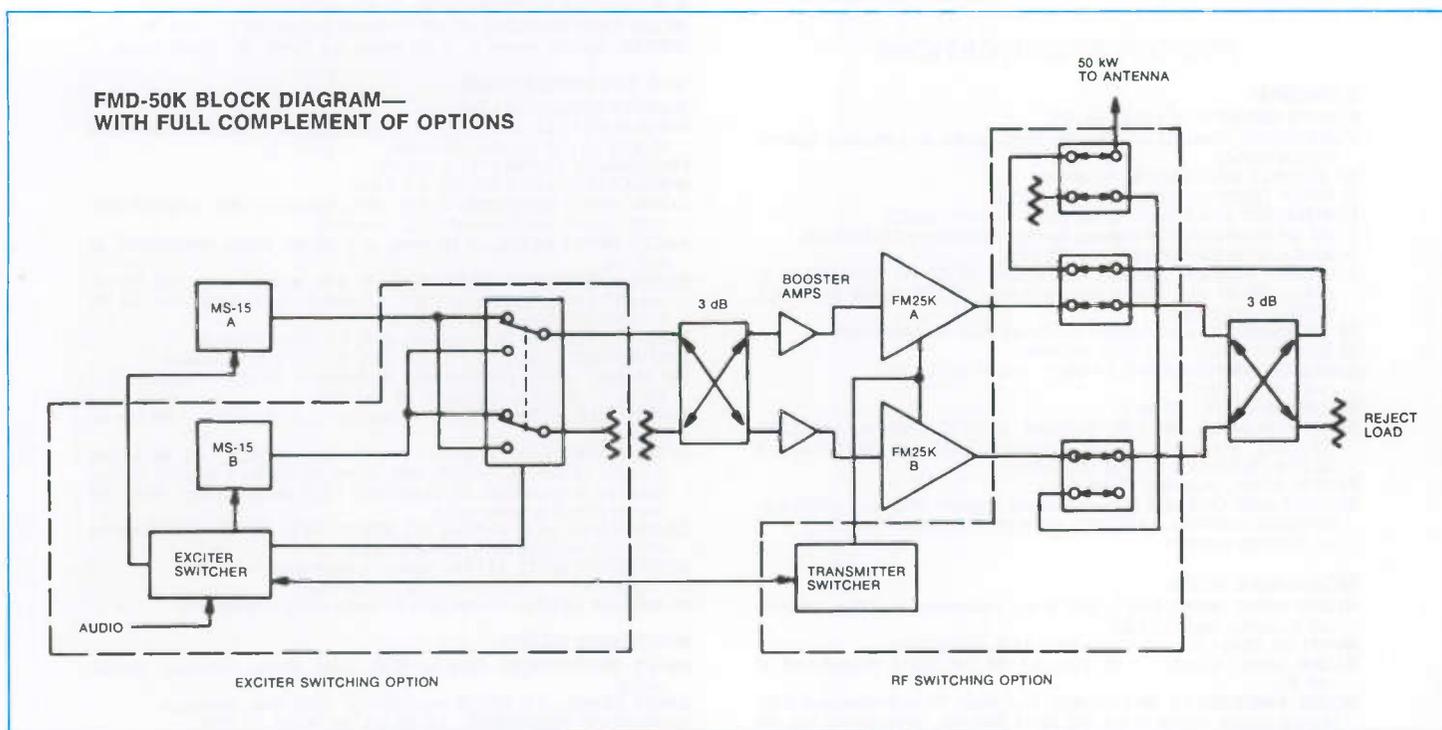
There are many other operational and convenience features incorporated into the FMD-50K. These include:

Line Loss Protection—Built-in protection against total AC failure and loss of phase is provided. The FMD-50K will restart automatically following a total power failure, while loss of a single phase will shut down the transmitter.

High Altitude Rating—High capacity, direct-drive blowers deliver sufficient air to cool the transmitter at altitudes up to 10,000 feet (3048 meters).

Additional Protection—Magnetic circuit breakers are utilized to protect the blower motors, the filament supplies, the IPA supplies and the bias supplies. A safety interlock system and a drop solenoid system discharge power supplies to safe levels.

Automatic Transmitter System Compatibility—The simple control logic interface and full metering in the FMD-50K permit ATS operation.



HARRIS' FMD-50K DUAL FM TRANSMITTER CONFIGURATIONS

BASIC FMD-50K DUAL SYSTEM

- Two FM-25K transmitters, less exciter.
- One MS-15 exciter.
- One dual RF booster amplifier with low power hybrid coupler and reject load.
- One 19-inch center cabinet with control and metering circuitry.
- One high power hybrid coupler with interconnecting transmission line components.
- One 12.5-kilowatt reject load.

FMD-50K WITH AUTOMATIC RF OUTPUT SWITCHING

- Two FM-25K transmitters, less exciter.

- One MS-15 exciter.
- One dual RF booster amplifier with low power hybrid coupler and reject load.
- One 19-inch center cabinet with control metering and RF control logic assembly.
- One floor-mounted frame assembly with three high power coaxial switches, one high power hybrid combiner, and one 12.5-kilowatt reject load.
- All necessary interconnecting transmission line components.

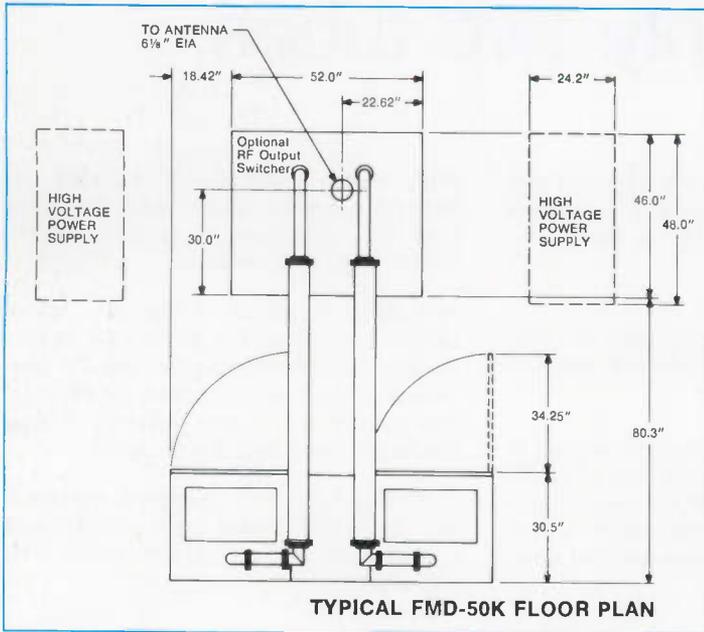
OPTIONAL AUTOMATIC EXCITER SWITCHING

- One automatic RF control logic assembly.

- One coaxial transfer switch.
- One test load for exciter.
- All necessary cabling for system interconnect.
- (Requires second exciter, which is not included in this option package).

ADDITIONAL OPTIONS FOR FMD-50K

- Mono generator(s).
- Stereo generator(s).
- SCA generator(s).
- RF input manual patch panel for use with exciter switching option.
- 80-kilowatt water-cooled test load.
- Heat exchanger for test load.



TYPICAL FMD-50K FLOOR PLAN

FMD-50K SPECIFICATIONS

GENERAL

POWER OUTPUT: 20 kW to 50 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 6 1/2" EIA flange.
FREQUENCY STABILITY: ± 300 Hz 0° to 45° C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation.
MODULATION CAPABILITY: ± 100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 50/60 Hz. 360/415 V, 3-phase, 50/60 Hz. Power consumption: 80,000 watts (approx.). 115 V as available.
RF HARMONICS: Suppression meets all FCC requirements.
ALTITUDE: 10,000 feet (3048 meters).
AMBIENT TEMPERATURE RANGE: -20° C to $+45^\circ$ C (-4° to $+113^\circ$ F).
MAXIMUM VSWR: 1.7 to 1.
SIZE: Transmitter: 90.2"W (229 cm) x 72"H (183 cm) x 30.5"D (77.5 cm). HV power supply cabinets: (each) 48"W (122 cm) x 60.2"H (153 cm) x 24.2"D (61.5 cm).
FINISH: White, blue and black.
WEIGHT AND CUBAGE (Approximate): Export: 7000 lbs. (3178 kg). Domestic: 6800 lbs. (3087 kg). Cubage: 400 cubic feet (11.3 cubic meters).

MONAURAL MODE

AUDIO INPUT IMPEDANCE: 600 ohms balanced, resistive, adaptable to other impedances.
INPUT FILTER: Controlled response LPF, defeatable.
AUDIO INPUT LEVEL: $+10$ dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30-15,000 Hz. Selectable: flat, 25 or 50 microsecond pre-emphasis.

HARMONIC DISTORTION: 0.2% or less, 30-15,000 Hz.
IMD: 0.2%, 60/7000 Hz, 4:1 ratio.
FM NOISE: 68 dB below 100% modulation (ref. 400 Hz @ ± 75 kHz deviation).
AM NOISE: 50 dB below reference carrier AM modulation 100%.

STEREOPHONIC MODE

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: (left and right) 600 ohms balanced, resistive. Adaptable to other impedances.
AUDIO INPUT LEVEL: (left and right) $+10$ dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: (left and right) standard 75 microsecond, FCC pre-emphasis curve ± 0.5 dB 30-15,000 Hz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz LPF, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Dynamic transient response (DTR) filter.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state. Defeatable for test purposes.
HARMONIC DISTORTION: (left or right) 0.4% or less, 30-15,000 Hz.
IMD: 0.4%, 60/7000 Hz, 4:1 ratio.
FM NOISE: (left or right) 65 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 kHz deviation.
PILOT OSCILLATOR: Crystal controlled.
PILOT STABILITY: 19 kHz ± 1 Hz, 0° to 45° C.
PILOT PHASE: Automatically controlled.
STEREO SEPARATION: 40 dB minimum 30-15,000 Hz.
CROSSTALK: (main to stereo sub-channel or stereo sub-to main channel) 45 dB below 90% modulation.
SUB CARRIER SUPPRESSION: 50 dB below 90% modulation.
76 kHz SUPPRESSION: 60 dB minimum below 100% modulation.
MODES: Stereo, mono (L + R), mono (L), mono (R). Remoteable.

SCA SPECIFICATIONS

MODULATION: Direct FM.
FREQUENCY: 41 or 67 kHz programmable, any frequency between 25 and 75 kHz on special order.
FREQUENCY STABILITY: ± 500 Hz.
MODULATION CAPABILITY: ± 7.5 kHz.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled) and 2000 ohms unbalanced (DC coupled).
AUDIO INPUT LEVEL: $+10$ dBm, ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: 41 kHz and 67 kHz, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable: flat, 50 or 75 microsecond pre-emphasis.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard.
DISTORTION: Less than 1%, 30-5000 Hz. ± 5 kHz deviation.
FM NOISE: (main channel not modulated) 55 dB minimum (ref: 100% = ± 5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel): -60 dB or better.
CROSSTALK: (main or stereo sub-channel to SCA): 50 dB below ± 5 kHz deviation of SCA, with mono or stereo channels modulated by frequencies 30-15,000 Hz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 kHz/67 kHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite. Adjustable.

WIDEBAND MODE

INPUT IMPEDANCE: Greater than 5000 ohms resistive, unbalanced.
INPUT LEVEL: 1.0 VRMS nominal for ± 75 kHz deviation.
AMPLITUDE RESPONSE: ± 0.25 dB, 30 Hz to 75 kHz.
PHASE LINEARITY: $\pm 2^\circ$, 30 Hz to 75 kHz.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

ORDERING INFORMATION

FMD-50K, dual 50-kilowatt FM transmitter, with automatic RF output switching, for wideband operation	994-8455-001
FMD-50K, dual 50-kilowatt FM transmitter, basic system, for wideband operation	994-8455-002
Automatic exciter switching option (does not include second exciter)	994-8456-001
MS-15 exciter (does not include generator modules)	994-7950-002
Monaural generator (add for mono operation)	994-8019-001
DSM stereo generator with DTR (add for stereo operation)	994-8020-001
SCA generator (add for SCA operation, specify 41 or 67 kHz)	994-7992-001
RF input patch panel	994-8473-001
80-kilowatt water-cooled test load	700-0121-000
Heat exchanger for test load	432-0257-000

HARRIS CORPORATION Broadcast Products Division
 P. O. Box 4290, Quincy, Illinois 62301 U.S.A. 217/222-8200



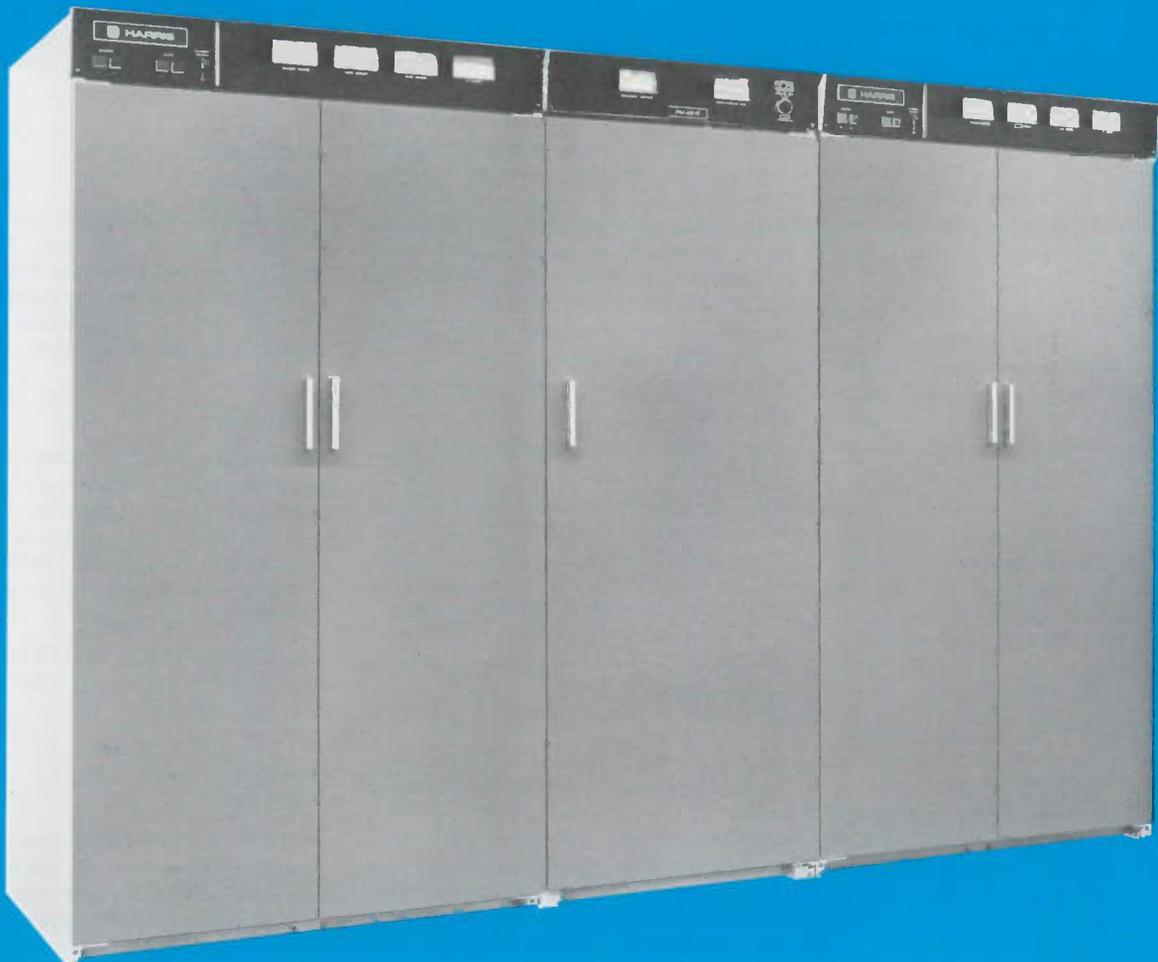
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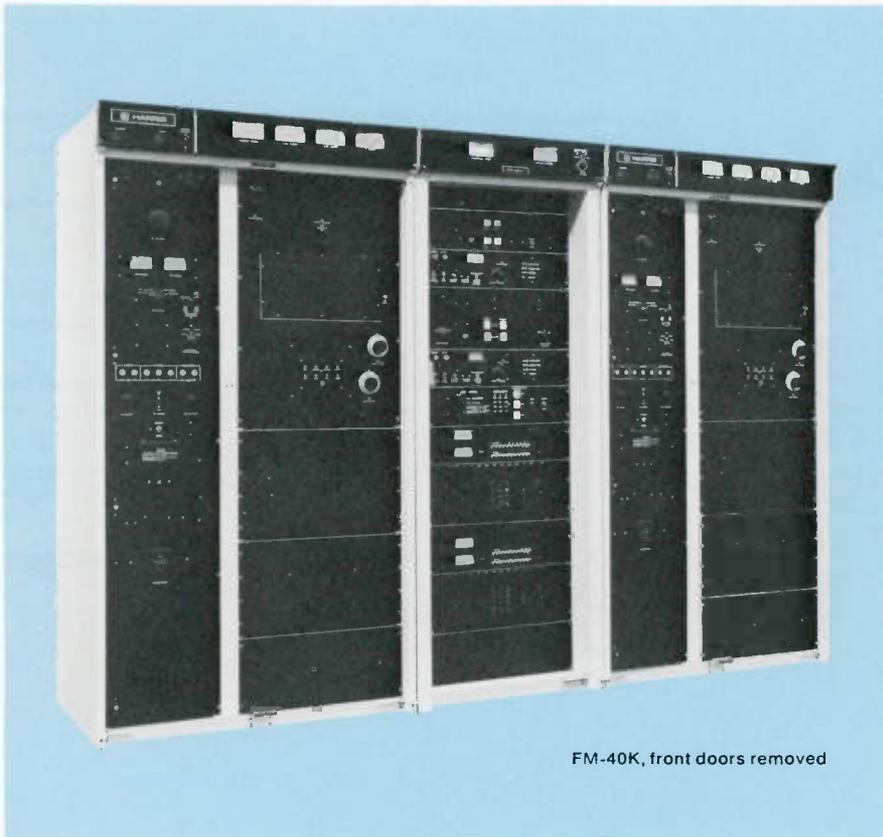
FM-40K

**40-Kilowatt
FM
Broadcast
Transmitter**

- Combines two high efficiency FM-20K transmitters for highest reliability and low operating cost
- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Digitally Synthesized Modulation stereo generator yields 48 dB minimum separation for increased stereo realism
- Dynamic Transient Response (DTR*) stereo generator filter maximizes modulation level without overmodulating
- Stable "VARI-LINE" output tuning requires fewer adjustments
- VSWR circuitry provides fault protection to your costly antenna and transmission line equipment

*Patented





FM-40K, front doors removed

Reliability through redundancy—that's the story on Harris' FM-40K, 40-kilowatt transmitter.

The basic FM-40K transmitter system consists of two 20-kilowatt amplifiers, and a center control cabinet containing the MX-15 exciter—and provides redundancy in all areas except the exciter and isolation amplifier. In case emergency operation is required, you stay on the air at one-quarter normal power output.

The complete 40-kilowatt FM transmitter system includes an optional Automatic Exciter Switching Kit and RF Output Switching Kit—and provides total redundancy! Should a malfunction occur anywhere in the system, you are still on the air at one-half normal power!

In the basic system, outputs of each amplifier are coupled through harmonic filters to the output combining network. This hybrid network sums the two 20-kilowatt signals to produce a 40-kilowatt output to the transmission line. However, the two amplifiers remain isolated from each other.

With the addition of the Automatic Exciter Switching Kit, automatic backup exciter protection is provided. And with the further addition of the RF Output Switching System, power output becomes one-half the normal output during emergency operation. Either or both of these options may be included in the FM-40K at the time you order—or added later in the field.

FINEST STEREO PERFORMANCE

Featuring the advanced-design MX-15 exciter, Harris' FM-40K provides the cleanest and the loudest stereo signal of any 40-kilowatt FM transmitter available today. The DSM (Digitally Synthesized Modulation) stereo generator allows the transmitter to provide **stereo separation of 48 dB minimum (typically 60 dB midband)**, 30-15,000 Hz—while the DTR (Dynamic Transient Response) filter permits a **2 to 6 dB increase in loudness**, with no degradation of audio quality, by limiting overshoot to 2% or less.

The FM-40K may be equipped for wide-band, mono or stereo operation, with or without SCA. The design versatility of the MX-15 exciter allows you to order for mono operation originally, then add stereo and/or SCA at a later date by plugging the appropriate module(s) into the exciter.

LOWEST OPERATING COST

In the FM-40K, each of the 20-kilowatt amplifiers operates at **80% efficiency** or better. Add to this conservatively rated components and you have the lowest operating cost of any FM transmitter in the 40-kilowatt power range. The 4CX15,000A output tube in each 20-kilowatt amplifier assures excellent performance—and runs

at only one-third its dissipation rating for maximum service life.

VARI-LINE SILVER-PLATED TANK

Vari-Line is an advanced, Harris-developed method of tuning a single-ended FM amplifier for optimum output efficiency. A portion of a parallel tubular 2-5/8-inch copper transmission line (silver plated for efficient RF service) is made variable in order to inductively tune the line to operating frequency. This reduces the complexity of sliding contacts and consequent maintenance problems.

With Vari-Line tuning, greater reliability is possible. Mica capacitors are not used in the tank circuit.

DUAL HV POWER SUPPLIES

Two separate three-phase HV power supplies are used for each 20-kilowatt amplifier. With each amplifier one HV supply—for PA plate voltage—is housed in a separate enclosure; the other supply, which powers the IPA plate and screen circuit, and the PA screen, is housed in the amplifier cabinet.

The FM-40K employs a special power supply protective circuit to assure that transient voltages or on-off power surges will not damage the power transformer and related components.

AUTOMATIC RECYCLING

In case of momentary overload, the transmitter recycles automatically. Should the overload reoccur in excess of the number of times preset in the transmitter, the FM-40K will then remain off the air until reset, either locally or by remote control.

TESTING

Environmental tests, in conditions surpassing those of any location a transmitter is likely to encounter, have been imposed on the FM-40K. The transmitter is capable of operating at altitudes up to 7500 feet (2286 meters), in an ambient temperature range of -20° to $+45^{\circ}$ C (-4° to $+113^{\circ}$ F).

In addition, your FM-40K is fully tuned and operationally tested on your frequency before shipment.

REMOTE CONTROL

All basic remote control metering samples and control connections are standard in the Harris FM-40K transmitter. This permits easy interface with Harris and other remote control systems.

ADDITIONAL FEATURES

There are many other operational and convenience features incorporated into the FM-40K. These include:

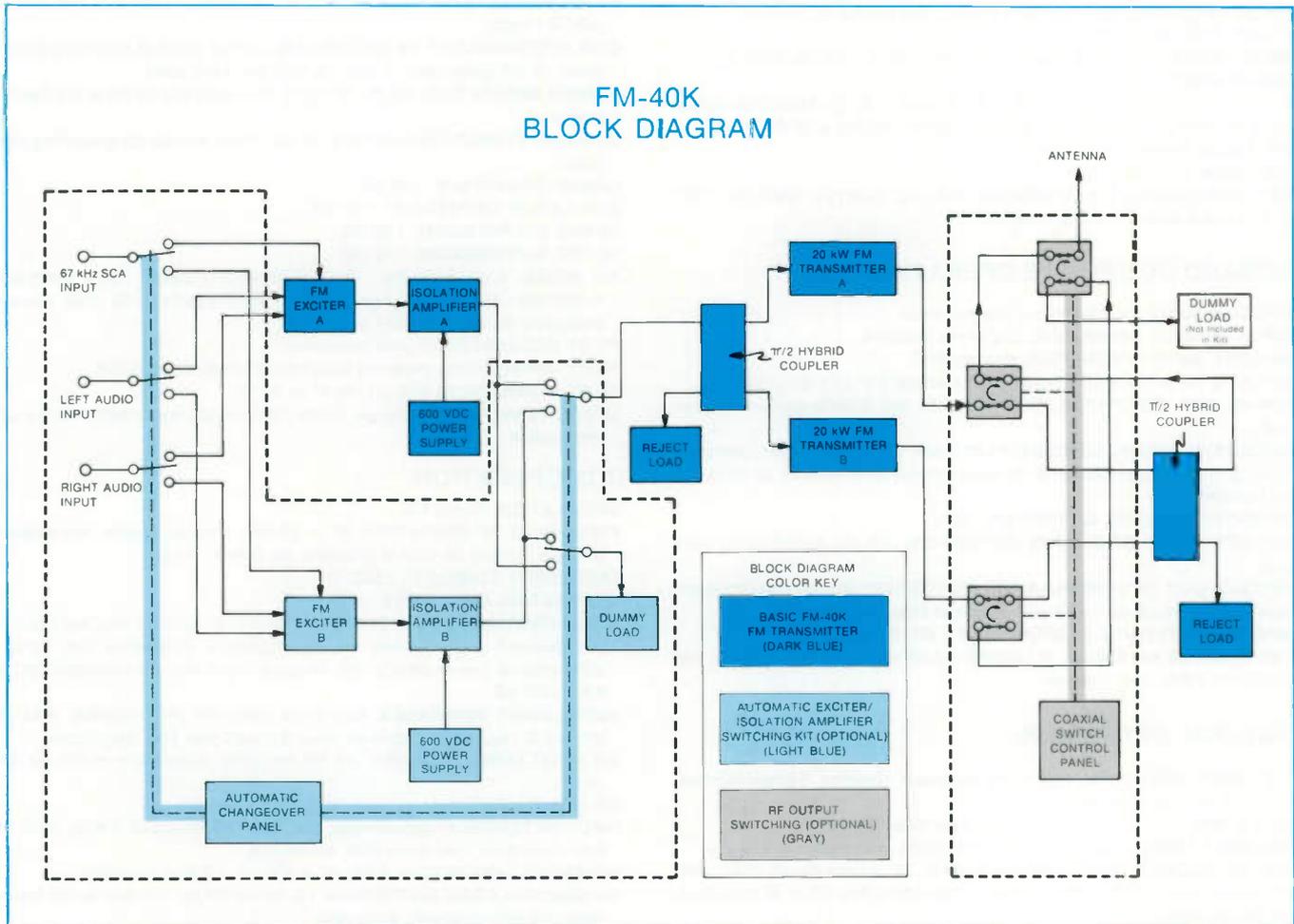
PUSHBUTTON OPERATION. Daily operation of the FM-40K is simple, with on-off functions controlled by lighted pushbuttons, which are clearly marked "Filament On-Off" and "Plate On-Off".

HIGH CAPACITY BLOWERS. (one in each 20-kilowatt amplifier). Backed up by precision air-pressure switches, these blowers provide complete protection to the IPA and PA tubes.

EASE OF MAINTENANCE. The FM-40K is designed to allow quick accessibility to all components for easier maintenance and troubleshooting.

HANDSOME STYLING. Transmitter cabinets are attractively yet functionally styled, with double front doors on each 20-kilowatt amplifier. The finish is white, blue and black.

TYPE ACCEPTANCE. Harris' FM-40K is FCC type accepted for composite, mono, stereo and SCA broadcasting in the 87.5 to 108 MHz band.



HARRIS' FM-40K FM TRANSMITTER CONFIGURATIONS

Basic Dual System

- Two FM-20K transmitters, each with individual VSWR protection and status light panels (less individual exciters)
- One MX-15 exciter
- One isolation amplifier with power supply
- One center cabinet
- One high-power hybrid coupler (combiner) with plumbing to interconnect two transmitters
- One low-power hybrid coupler
- One 10-kilowatt reject load
- One 50-watt reject load

Automatic Exciter/Isolation Amplifier Switching Kit (Optional)

For exciter redundancy, the following additional equipment (included in this kit) should be added to the basic system:

- One MX-15 exciter
- One isolation amplifier with power supply
- One test load for exciter
- One automatic changeover contact panel (mounts in center cabinet)

RF Output Switching (Optional)

For RF switching of the high-power output amplifiers, the following equipment (included in this kit) should be added to the basic system:

- One control panel (mounts in center cabinet)
- Three coaxial transfer switches
- One kit consisting of rigid coaxial line, elbows and flanges
- One 50-kilowatt test load required (not included in kit)

Optional Equipment For FM-40K

- Mono generator module
- Stereo generator module
- SCA generator module(s)
- 50-kilowatt air-cooled load
- 50-kilowatt water-cooled load

FM-40K SPECIFICATIONS

GENERAL

POWER OUTPUT: 20 kW to 40 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 3/8" EIA flange.
FREQUENCY STABILITY: ± 300 Hz 0° to 45° C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation.
MODULATION CAPABILITY: ± 100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 60 Hz. (50 Hz available on special order.) Power consumption: 60,000 watts (approx.). 115/230 V, 60 or 50 Hz, 150 watts for MX-15, for an overall efficiency of approx. 66%.
RF HARMONICS: Suppression meets all FCC requirements.
ALTITUDE: 7500 feet (2286 meters).
AMBIENT TEMPERATURE RANGE: -20° C to $+45^\circ$ C (-4° to $+113^\circ$ F).
MAXIMUM VSWR: 1.7 to 1.
SIZE: Transmitter: 113"W (287cm) x 78"H (198cm) x 33"D (84cm). HV power supply cabinets (2): each 30"W (76cm) x 49"H (125cm) x 30"D (76cm).
FRONT DOOR SWING: 21" (53cm).
FINISH: White, blue and black.
WEIGHT AND CUBAGE: Export: 6800 lbs. (3087 kg). Domestic: 6000 lbs. (2724 kg). 270 cubic feet (7.5 cubic meters).

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 200 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ± 75 KHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 KHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 KHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .1% (60 Hz/7 KHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 75 dB (reference 14 KHz/15 KHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 KHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 50 dB below reference carrier AM modulation 100% output power.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 KHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 KHz de-emphasized.
INTERMODULATION DISTORTION: .15%, 60 Hz/7 KHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 KHz/15 KHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 KHz deviation, measured 20 Hz to 200 KHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).

AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms balanced, resistive, transformerless, adaptable to other impedances.
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB 30 Hz-15 KHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 KHz low pass filter, 45 dB rejection at 19 KHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) .2% 60 Hz/7 KHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 70 dB (reference 14 KHz/15 KHz test tone pair).
STEREO SEPARATION: 48 dB, 30 Hz-15 KHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -50 dB.
NON-LINEAR CROSSTALK: -60 dB.
76 KHZ SUPPRESSION: -68 dB.
38 KHZ SUPPRESSION: -73 dB.
FM NOISE: (Left to right) -74 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis. ± 75 KHz deviation, measured 30 Hz to 15 KHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ± 1 Hz 0° to 50° C.
OPERATIONAL MODES: Stereo, mono (left to right), mono (left), mono (right) - remoteable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 67 or 92 KHz programmable. Any frequency between 25 and 95 KHz is available on special order.
FREQUENCY STABILITY: ± 500 Hz.
MODULATION CAPABILITY: ± 7.5 KHz.
AUDIO FREQUENCY RESPONSE: 41 KHz and 67 KHz AC coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable: flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 KHz ± 0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 KHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 KHz standard. 3 KHz, 5 KHz, 7.5 KHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ± 5 KHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 KHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB. (reference: 100% modulation = ± 5 KHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel): -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA): -52 dB below ± 5 KHz deviation of SCA, with mono or stereo channels modulated by frequencies 30 Hz-15 KHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 KHz/67 KHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

ORDERING INFORMATION

FM-40K, 40-kilowatt FM transmitter, basic system, for wideband operation, 60 Hz	994-8053-002
Automatic exciter/isolation amplifier switching kit	994-6876-001
RF output switching package	994-6877-001
Monaural generator (add for mono operation)	994-8019-001
DSM stereo generator with DTR (add for stereo operation)	994-8020-001
SCA generator (add for SCA operation, specify 67 or 92 kHz)	994-7992-001
50-kilowatt air-cooled test load	700-0317-000
50-kilowatt water-cooled test load	700-0239-000

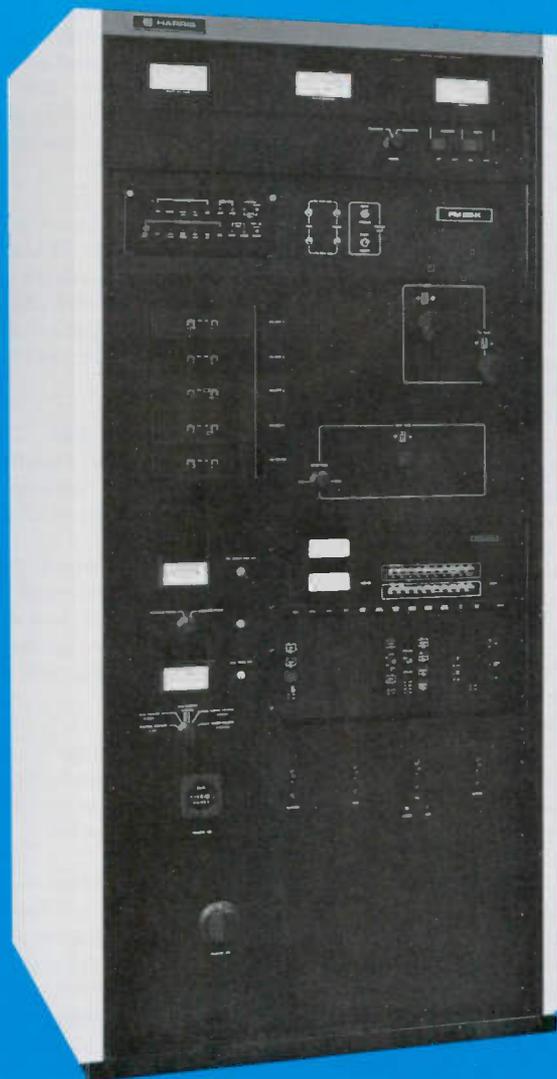
HARRIS CORPORATION BROADCAST GROUP
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200



HARRIS

FM-25K

25-Kilowatt
FM Broadcast
Transmitter



- Advanced single tube design offers maximum reliability
- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Solid state IPA with built-in backup protection helps minimize down time
- Wide RF bandwidth does not degrade MX-15's exceptional audio performance
- Digitally Synthesized Modulation stereo generator yields 50 dB minimum separation for increased stereo realism
- Dynamic Transient Response (DTR*) stereo filter maximizes modulation level without overmodulating
- Automatic power control eliminates routine operator adjustment
- Quarter wave PA cavity has no troublesome fingerstock at high current points

*Patented

Harris' technology has combined advances in both tube and transistor designs, to bring you a major step forward in high-power FM transmitters. Transistors are now available which provide 50 watts of RF power at reasonable gain and low junction temperatures. By combining several of these transistors in wideband RF circuits, enough power can be generated to drive an advanced high-gain Eimac tetrode tube, the 8990. This tube, when grid driven in a grounded cathode, quarter-wave cavity, can produce 25 kilowatts with 350 watts of drive at nearly 80% plate efficiency!

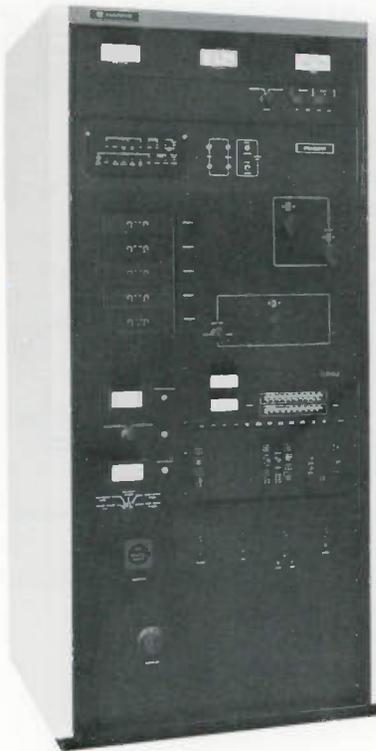
The FM-25K, twenty-five kilowatt FM transmitter reflects Harris' design philosophy that FM transmitters should deliver RF power efficiently, should not limit exciter performance, and should integrate dependable solid-state control logic. In the FM-25K, these features are teamed with efficient, single-tube design, and with the high performance MX-15 exciter.

The FM-25K was designed for applications with tower limitations or specific coverage requirements. The higher RF power output reduces the number of antenna bays required for a given ERP; and fewer bays mean a reduction in windloading and mounting area, so that tower size and/or height may be reduced. Also, fewer antenna bays, with less gain, can mean improved close-in coverage and the elimination of null fills.

SINGLE TUBE DESIGN

The FM-25K is the first high-power FM transmitter to utilize a single-tube design. A high-gain, highly efficient 8990 tetrode is the only tube in the entire transmitter, and is used as the final power amplifier. The tube uses a wavy fin radiator which provides excep-

Harris FM-25K...high efficiency...wide RF bandwidth...only one tube



tional cooling at reduced air requirements, for quiet operation. The quarter-wave PA cavity design eliminates troublesome sliding contacts for tuning, and assures wide RF bandwidth. This results in a signal path that is transparent to the MX-15 Exciter.

SOLID-STATE IPA

Five solid-state power amplifier modules (2 amplifiers per module) are combined to produce 350 watts of drive power, with plenty of reserve. One module functions as the IPA driver, and the other four as driver power amplifiers. All of these modules are identical, so that in case the IPA driver should fail, one of the power amplifier modules may be inserted in its place. Loss of one of the four driver amplifier modules will not result in an off-air condition, as these solid-state amplifiers are isolated from each other. All five solid-state amplifier modules are broadbanded, and require no individual tuning over the entire 88-108 MHz band.

Unlike other FM transmitters that use 90% hybrid networks, the Harris FM-25K IPA section utilizes an "in-phase" power splitting/combining configuration that presents equal loads to each amplifier. This Harris technique minimizes IPA stress to insure reliable operation. The solid-state, modular IPA affords back-up capability for greatly improved reliability, and reduces overall transmitter tuning requirements.

LOW OPERATING COST

With today's mounting energy costs, transmitter efficiency must be a major consideration in any purchase. Efficiency in the final power amplifier circuits approaches 77%. Conservatively rated components result in comparatively low power consumption and low operating stress on heat generating components in the FM-25K. This adds up to very impressive savings from reduced operating and maintenance costs.

AUTOMATIC POWER CONTROL

The FM-25K automatically monitors RF power output, and maintains the output at the desired level. This standard feature insures against out-of-tolerance power conditions. Furthermore, the power set point can be remotely adjusted independently of the limit points to allow operator control of power output. During maintenance periods, the automatic power control may be switched off.

VSWR PROTECTION

VSWR protection is mandatory in any high power transmitter—therefore, Harris has incorporated this as a standard feature in the FM-25K. A high VSWR condition will cause the transmitter to automatically recycle...if three overloads occur within a given time period, the transmitter will shut down until manually restarted. The transmitter may also be programmed for single VSWR overload shutdown.

CONTROL CIRCUITRY

The FM-25K is controlled by solid-state logic circuitry. The logic circuitry not only controls basic On/Off functions, but also monitors critical stages for overload conditions. Should an overload occur, the transmitter will recycle automatically, according to the number of times pre-set (one or three).

The control logic used in the FM-25K interfaces directly with most remote control systems, eliminating the need for an additional remote control interface. The control signals are momentary low current contact closures. The transmitter output parameters are buffered, and all status indicators are remoted. This FM-25K feature allows stations to remote a wealth of diagnostic information to the remote control point.

METERING AND VISUAL AIDS

Major functions, including RF output, VSWR and PA parameters are displayed on easy-to-read four-inch meters. Low-level parameters are displayed on a multimeter, and IPA RF output and reflected power are indicated on another meter. Filament voltage is measured by a true RMS circuit to help achieve long tube life. The FM-25K provides a variety of indicators as trouble shooting aids and quick references. These include four illuminated On/Off pushbuttons and 26 LEDs, not including those on the MX-15 Exciter.

HV POWER SUPPLY

The high voltage power supply is housed in a separate cabinet, and provides the plate and screen supplies. The conservatively rated three-phase plate supply uses silicon rectifiers with AC line transient protection.

COMPACT SIZE

The trim PA cabinet can fit as a replacement for most older 20- to 25-kilowatt transmitters. The cabinet is only 35 inches wide, 72 inches high and 31 inches deep. Additionally, the HV power supply may be located in any convenient spot remote from the PA cabinet.

ADDITIONAL FEATURES

There are many other standard operational and convenience features incorporated into the FM-25K. These include:

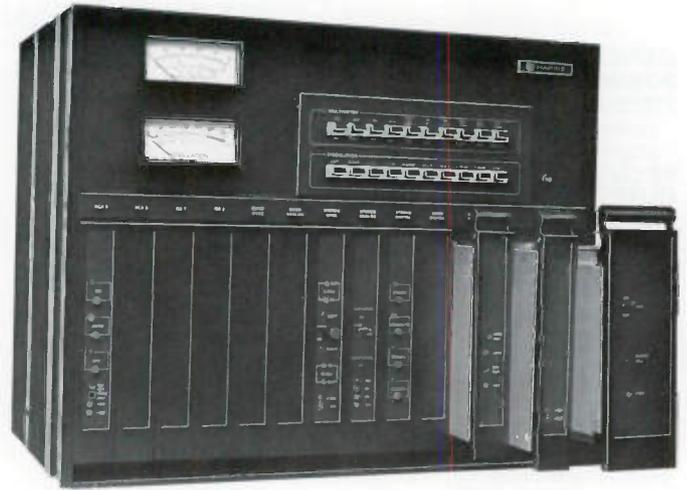
Line loss protection—built-in protection against total AC failure and loss of phase is provided. The FM-25K will restart automatically following a total power failure, while loss of a single phase will shut down the transmitter.

High altitude rating—a high capacity, direct-drive blower delivers sufficient air to cool the transmitter at altitudes up to 10,000 feet (3048 meters).

Additional protection—four magnetic circuit breakers are utilized to protect the blower motor, the filament supply, the IPA supply and the bias supply. A wide-ranging interlock system and a drop solenoid system quickly discharge power supplies to safe levels.

ATS compatibility—the simple control logic interface and full metering in the FM-25K permit ATS operation.

Harris MX-15 Exciter . . . new levels of excellence in FM audio performance



Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low .02%, with all CCIF Intermodulation distortion products below 80 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ± 100 kHz.

Equally impressive is the FM-25K/MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

DIGITAL SYNTHESIZER

The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison against WWV transmissions. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ± 10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.

DIGITALLY SYNTHESIZED MODULATION

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Stereo separation typically exceeds 50 dB from 30 to 15,000 Hz.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION

A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION

Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation continuously. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations

programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER

The power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL BENEFITS

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.

FM-25K TRANSMITTER SPECIFICATIONS

GENERAL

POWER OUTPUT: 10 kW to 25 kW.

FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency. Exciter programmable in 50 kHz increments.

RF OUTPUT IMPEDANCE: 50 ohms.

OUTPUT TERMINATION: 3/4" EIA flange.

FREQUENCY STABILITY: ± 300 Hz 0° to 45°C TCXO.

TYPE OF MODULATION: Direct Carrier Frequency Modulation.

MODULATION CAPABILITY: ± 100 kHz.

AC INPUT POWER: 208/240 V, 3-phase, 50/60 Hz and 360/415 V, 3 phase, 50/60 Hz, 4-wire. Power consumption: 40 kW typical.

RF HARMONICS: Suppression meets all FCC requirements.

ALTITUDE: 10,000 feet (3048 meters).

AMBIENT TEMPERATURE RANGE: -20°C to +50°C. Maximum temperature 50°C @ sea level, decreasing 2°C per 1000 feet (305 meters) to 30°C maximum at 10,000 feet (3048 meters).

MAXIMUM VSWR: 1.7 to 1.

SIZE: Transmitter cabinet, 34.6" W (87.8 cm) \times 71.7" H (182.1 cm) \times 31.0" D (78.7 cm). HV power supply cabinet: 48.0" W (121.9 cm) \times 60.2" H (152.9 cm) \times 24.2" D (61.5 cm).

FINISH: White, blue and black.

WEIGHT & CUBAGE: (Estimated) Export: 3000 lbs. (1361 kg).

Domestic: 2700 lbs. (1225 kg). Cubage: 150 cubic feet.

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.

COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.

COMPOSITE INPUT CONNECTOR: Female BNC.

COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ± 75 kHz deviation.

EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).

COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).

COMPOSITE HARMONIC DISTORTION: .08%.

COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 kHz 1:1 tone pairs).

COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).

COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 kHz.

ASYNCHRONOUS AM SIGNAL TO NOISE: 55 dB below reference carrier AM modulation 100% output power.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

INPUT FILTER: Controlled response low pass filter, defeatable.

AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.

AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.

HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.

INTERMODULATION DISTORTION: 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.

CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).

FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).

AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation.

AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.

INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.

OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.

AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.

HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.

INTERMODULATION DISTORTION: (Left or right) 0.12% 60 Hz/7 kHz test tone pair, 4:1 ratio.

CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 75 dB (reference 14 kHz/15 kHz test tone pair).

STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.

DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.

LINEAR CROSSTALK: -50 dB.

NON-LINEAR CROSSTALK: -60 dB.

76 kHz SUPPRESSION: -68 dB.

38 kHz SUPPRESSION: -73 dB.

FM NOISE: (Left or right) 72 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.

PILOT OSCILLATOR: Crystal controlled.

PILOT PHASE: Harris patented automatic pilot phasing circuit.

PILOT STABILITY: 19 kHz ± 1 Hz 0° to 50°C.

OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—remoteable.

SCA OPERATION

MODULATION: Direct FM.

FREQUENCY OF OPERATION: 41 or 67 kHz programmable, any frequency between 25 and 75 kHz on special order.

FREQUENCY STABILITY: ± 500 Hz.

MODULATION CAPABILITY: ± 7.5 kHz.

AUDIO FREQUENCY RESPONSE: 41 kHz and 67 kHz AC coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ± 0.5 dB.

AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.

AC INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.

DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.

INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.

HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ± 5 kHz deviation.

INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).

FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = ± 5 kHz deviation at 400 Hz).

CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.

CROSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ± 5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.

CROSSTALK: SCA to SCA (41 kHz/67 kHz) -50 dB demodulated with 150 microsecond de-emphasis.

AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.

MUTE DELAY: Adjustable 0.5 to 20 seconds.

INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Specifications subject to change without notice.

ORDERING INFORMATION

FM-25K 25,000 watt FM broadcast transmitter with MX-15 exciter, for wideband operation, 50/60 Hz (Specify 50 or 60 Hz)	994-8258-001
Spare tube	374-0151-000
Mono generator (add for mono operation)	994-8019-001
DSM stereo generator with DTR (add for stereo operation)	994-8020-001
SCA generator (add for SCA operation, specify 41 or 67 kHz)	994-7992-001
Extended Control Panel for FM-25K	994-8475-001

HARRIS CORPORATION BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200



HARRIS

FM-20K

20-Kilowatt
FM Broadcast
Transmitter

- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Digitally Synthesized Modulation stereo generator yields 48 dB minimum separation for increased stereo realism
- Dynamic Transient Response (DTR*) stereo generator filter maximizes modulation level without overmodulating
- 80% final PA efficiency yields long tube life and low power consumption for direct operating cost savings
- Standard VSWR protection provides fault protection to antenna and transmission line equipment
- Convenient operation—full metering, status lights and remote control termination are just a few of the standard features which minimize maintenance and installation time

*Patented





FM-20K, front view, doors open.

The FM-20K employs Harris' advanced-design MX-15 solid-state exciter, with Digitally Synthesized Modulation (DSM), to provide the very finest stereo signal available. Technical specifications are exceptional compared to other 20 kilowatt FM transmitters on the market. And DSM with overshoot compensation allows a 2 to 6 dB increase in loudness with no degradation of audio quality.

LOW OPERATING COST

80% efficiency in the final amplifier, plus high efficiency in all amplifier circuits, plus conservatively rated components combine to give the FM-20K the lowest operating cost of any transmitter in its power range. As amplifier tubes are operated at only a fraction of their actual rating, maximum service life is assured. You save both on power bills and on tube costs.

THREE TUBES

Only three tubes (two tube types) are used in the FM-20K. The MX-15 drives the intermediate power amplifier, consisting of two parallel 4CX250B's. The final single-ended power amplifier is a 4CX15000A ceramic tetrode, which provides excellent performance, and runs at only one-third its dissipation capability.

"VARI-LINE" SILVER PLATED TANK

Vari-Line is an advanced, Harris-developed method of tuning a single-ended FM amplifier for optimum output efficiency. A portion of a parallel tubular 2 $\frac{5}{8}$ -inch copper transmission line (silver plated for efficient RF service) is made variable in order to inductively tune the line to operating frequency.

With Vari-Line tuning, greater reliability is possible. Mica capacitors are not used in the tank circuit. This reduces the complexity of sliding contacts and consequent maintenance problems.

PLUG-IN MONO, STEREO AND SCA GENERATORS

The FM-20K may be equipped for mono or stereo operation, with or without SCA. The design versatility of the exciter allows you to order for mono operation originally, then add stereo and/or SCA at a later date by plugging the appropriate module(s) into the exciter. Since the SCA generators have spectrally pure filtered outputs, 41 and 67 kHz SCA channels may be operated simultaneously, while in the mono mode, without harmonic interference.

DUAL HV POWER SUPPLY

Two separate three-phase power supplies

are used for the FM-20K—both featuring protection against transient voltages or on-off power surges.

One HV power supply—for PA plate voltage—is housed in a separate enclosure, while the supply powering the IPA plate and screen circuit, and the PA screen, is housed in the main transmitter cabinet.

AUTOMATIC RECYCLING

In case of momentary overload, the transmitter recycles automatically. Should the overload reoccur in excess of the desired number of times preset in the transmitter, the FM-20K will then remain off the air until it is reset, either locally or by remote control.

TESTING

Environmental tests, in conditions surpassing those of any location a transmitter is likely to encounter, have been imposed on the FM-20K. The transmitter is capable of operating at altitudes to 7500 feet, in an ambient temperature range of -20° to $+45^{\circ}$ C.

In addition, your FM-20K is fully tuned and operationally tested on your frequency before shipment.

REMOTE CONTROL

All remote control provisions are built-in. No additional transmitter kits or options are needed.

FULL METERING

Eight easy-to-read meters, including a multimeter, provide full monitoring of the seventeen parameters of the operating tubes and exciter. There is also a directional coupler which measures forward power and VSWR, and an elapsed time meter.

ADDITIONAL FEATURES

There are many other operational and convenience features incorporated into the FM-20K. These include:

Pushbutton Operation—On-off functions are controlled by lighted pushbuttons at the top left of the transmitter. These are clearly marked "Filament On-Off", "Plate On-Off".

High-Capacity Blower—backed up by a precision air-pressure switch gives complete protection to the IPA and PA tubes.

Straightforward Design—allows easy accessibility to all components.

Front Panel Test Points—permit fast checking of exciter circuit conditions.

Handsome Styling—the transmitter cabinet is attractively yet functionally styled, with double front doors. The finish is white and blue, with black meter panel.

FCC Type Acceptance—the FM-20K is FCC type accepted for mono or stereo broadcasting in the 87.5 to 108 MHz FM band.

Harris MX-15 Exciter . . . new levels of excellence in FM audio performance

Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features outstanding linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low 0.1%, with all CCIF Intermodulation distortion products down at least 75 dB as measured through the FM-20K transmitter. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ± 100 kHz.

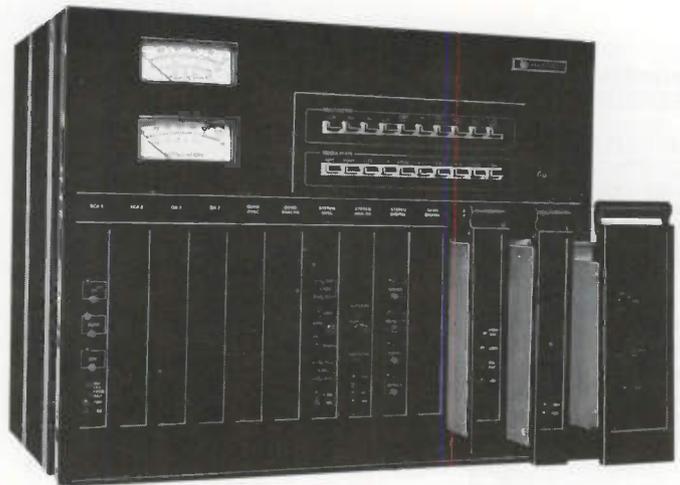
Equally impressive is the FM-20K/MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the exciter and transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the probability of ground loops and other system interface problems.

DIGITAL SYNTHESIZER

The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct frequency comparison against WWV transmissions. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 KHz increments. The dual-state AFC will acquire the VCO over a ± 10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.



DIGITALLY SYNTHESIZED MODULATION

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Separation through the FM-20K readily exceeds an impressive 48 dB specification over the 30-15,000 Hz range.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION

A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION

Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan televi-

sion or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER

The power amplifier module is solid-state, conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL EXCITER FEATURES

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used directly, without interface, with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.

FM-20K TRANSMITTER SPECIFICATIONS

GENERAL

POWER OUTPUT: 10 kW to 20 kW (type accepted to 21.5 kW).
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 3/8" EIA flange.
FREQUENCY STABILITY: ± 300 Hz 0° to 45° C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation.
MODULATION CAPABILITY: ± 100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 60 Hz. (50 Hz available on special order.) Power consumption: 30,000 watts (approx.). 115/230 V, 60 or 50 Hz, 150 watts for MX-15.
RF HARMONICS: Suppression meets all FCC requirements.
POWER SUPPLY RECTIFIERS: Silicon.
ALTITUDE: 7500 feet.
AMBIENT TEMPERATURE RANGE: -20° C to $+45^\circ$ C.
MAXIMUM VSWR: 1.7 to 1.
SIZE: Transmitter cabinet: 42" W (107 cm) \times 78" H (198 cm) \times 33" D (84 cm). HV power supply cabinet: 30" W (76 cm) \times 49" H (125 cm) \times 30" D (76 cm).
FRONT DOOR SWING: 21" (53 cm).
FINISH: White, blue and black.
WEIGHT & CUBAGE: Export: 2800 lbs. (1270 kg). Domestic: 2300 lbs. (1043 kg). 141 cubic feet.

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ± 75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .1% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 75 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 52 dB below reference carrier AM modulation 100% output power: 15 watts.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.2%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.2% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 75 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 48 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -48 dB.
NON-LINEAR CROSSTALK: -60 dB.
76 kHz SUPPRESSION: -68 dB.
38 kHz SUPPRESSION: -73 dB.
FM NOISE: (Left or right) 72 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ± 1 Hz 0° to 50° C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—remoteable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 41 or 67 kHz programmable, any frequency between 25 and 75 kHz on special order.
FREQUENCY STABILITY: ± 500 Hz.
MODULATION CAPABILITY: ± 7.5 kHz.
AUDIO FREQUENCY RESPONSE: 41 kHz and 67 kHz AC coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ± 0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ± 5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = ± 5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 55 dB below ± 5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 kHz/67 kHz) -50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Specifications subject to change without notice.

ORDERING INFORMATION

FM-20K 20,000 watt FM broadcast transmitter with MX-15 exciter, for wideband operation, 60 Hz	994-8052-002
Mono generator (add for mono operation)	994-8019-001
DSM stereo generator with DTR (add for stereo operation)	994-8020-001
SCA generator (add for SCA operation, specify 41 or 67 kHz)	994-7992-001

HARRIS CORPORATION BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200



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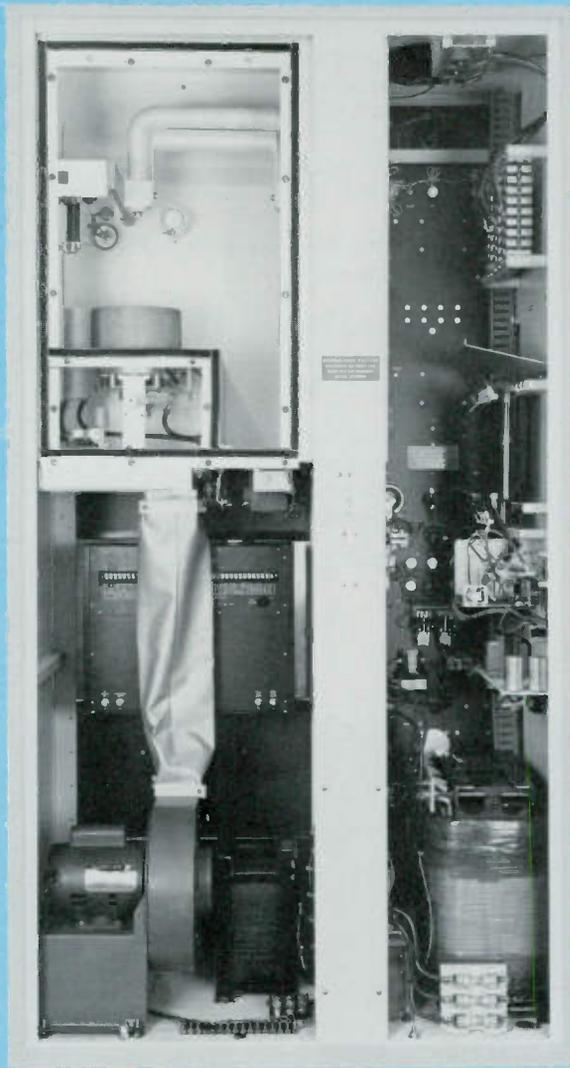
FM-10K

10-Kilowatt
FM Broadcast
Transmitter

- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Digitally Synthesized Modulation (DSM) stereo generator yields 48 dB minimum separation (60 dB typical at midband) for increased stereo realism
- Dynamic Transient Response (DTR*) stereo filter maximizes modulation level without overmodulating
- Stable "Vari-Line" output tuning requires fewer adjustments
- Standard VSWR protection—provides fault protection to your costly antenna and transmission line equipment
- Convenient operation—full metering, status lights and remote control termination are just a few of the standard features which minimize installation and maintenance time

*Patented





Featuring the advanced-design MX-15 exciter, Harris' FM-10K provides the cleanest and loudest stereo signal of any 10 kilowatt FM transmitter available today. The DSM (Digitally Synthesized Modulation) stereo generator allows the transmitter to provide stereo separation of 48 dB minimum, 30-15,000 Hz—while the DTR (Dynamic Transient Response) filter permits a 2 to 6 dB increase in loudness, with no degradation of audio quality, by limiting overshoot to 2% or less. Add to this high efficiency plus conservatively rated components and you have a really exceptional FM transmitter—the Harris FM-10K.

ONLY TWO TUBES. Just two tubes are employed in the FM-10K—a 4CX10,000J PA and a 4CX300A IPA. The ceramic-type 4CX10,000J is a high-gain tetrode that operates with a 2-to-1 dissipation safety margin, and was selected as the power amplifier because of its proven longer useful life.

"VARI-LINE" SILVER PLATED TANK.

Vari-Line is a Harris-developed method of tuning a single-ended FM amplifier for optimum output efficiency. A portion of a parallel tubular 1½ inch copper transmission line (silver plated for efficient RF service) is made variable in order to inductively tune the line to operating frequency.

VSWR PROTECTION. To protect the transmitter PA, a VSWR overload circuit has been incorporated. The VSWR circuit monitors the reflected power from the output directional coupler and interrupts the high voltage power supply when the VSWR exceeds a pre-determined level. The transmitter will attempt to restart, and if the VSWR clears, return to air. Multiple VSWR trips within a given period will cause the transmitter to shut down.

AUTOMATIC RECYCLING. In case of momentary overload, the transmitter recycles automatically. Should the overload

reoccur in excess of the desired number of times preset in the transmitter, the FM-10K will then remain off the air until it is reset, either locally or by remote control.

HV POWER SUPPLY. One three-phase HV power supply is used in the FM-10K. It provides the PA plate voltage, PA screen voltage, and powers the IPA plate and screen circuits. The bias supply for the PA is a bridge circuit of four rectifiers. The transmitter employs a special power supply protective circuit to assure protection from transient voltages or on-off power surges.

BUILT-IN REMOTE CONTROL. Connect the transmitter control unit to the transmitter, tie in the telephone line to the studio control unit, and you are ready for complete remote control operation. All necessary functions can be controlled remotely—and no additional equipment is required for a Harris control system.

TESTING. Environmental tests, in conditions surpassing those of any location a transmitter is likely to encounter, have been imposed on the FM-10K. The transmitter is capable of operating at altitudes up to 10,000 feet (3000 meters), in an ambient temperature range of -20° to +45° C.

In addition, your FM-10K is fully tuned and operationally tested on your frequency before shipment.

METERING AND VISUAL AIDS. Six easy-to-read meters, including four multimeters, provide full monitoring of twenty-eight parameters in the transmitter and the exciter. To aid in fault location, a system of indicator lights provides status display of important transmitter parameters.

ADDITIONAL FEATURES. There are many other operational and convenience features incorporated into the FM-10K. These include:

Pushbutton Operation—On-off functions are controlled by lighted pushbuttons at the top left of the transmitter. These are clearly marked "Filament On-Off", "Plate On-Off".

High-Capacity Blower—backed up by a precision air-pressure switch gives complete protection to the IPA and PA tubes.

Straightforward Design—allows easy accessibility to all components.

AC Interruption Restart—this feature provides for automatically returning the transmitter "on air" after a temporary or indefinite outage of the AC power source. A front panel override switch is also provided.

FCC Type Acceptance—the FM-10K is FCC type accepted for mono or stereo broadcasting in the 87.5 to 108 MHz FM band.

HARRIS MX-15 EXCITER...

NEW LEVELS OF EXCELLENCE IN FM AUDIO PERFORMANCE

Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO. The unique VCO (Voltage Controlled Oscillator) of the MX-15 features outstanding linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs. Wideband Composite Intermodulation Distortion through the FM-10K is an exceptionally low .05%, with all CCIF Intermodulation distortion products down at least 75 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ± 100 kHz.

Equally impressive is the FM-10K/MX-15's -80 db FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT. Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the probability of ground loops and other system interface problems.

DIGITAL SYNTHESIZER. The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct frequency comparison against WWV transmissions. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 KHz increments. The dual-state AFC will acquire the VCO over a ± 10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.

DIGITALLY SYNTHESIZED MODULATION. The Harris DSM stereo generation

technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Separation through the FM-10K is specified at an impressive 48 dB over the 30-15,000 Hz range.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION. A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION. Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television

or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER. The MX-15 power amplifier module is solid-state, conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING. Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

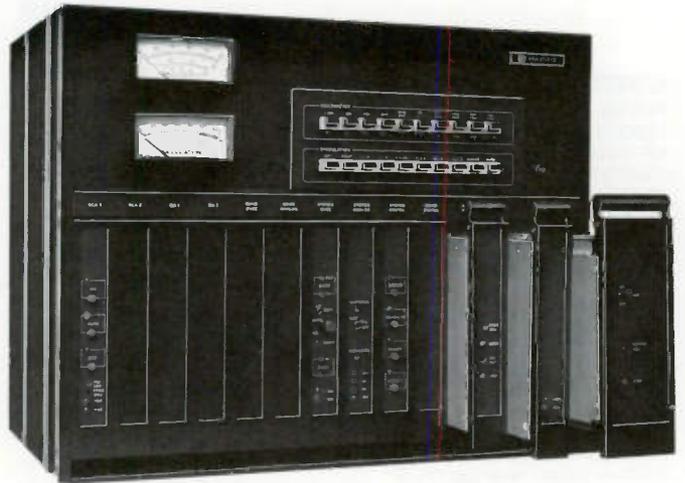
ADDITIONAL EXCITER FEATURES. The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadrasonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.



FM-10K SPECIFICATIONS

GENERAL

POWER OUTPUT: 10 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 3/8" EIA flange.
FREQUENCY STABILITY: ± 300 Hz 0° to 45° C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation.
MODULATION CAPABILITY: ± 100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 60 Hz (50 Hz available.) Power consumption: 17,000 watts (approx.). 115/230 V, 60 or 50 Hz, 150 watts for MX-15.
RF HARMONICS: Suppression meets all FCC requirements.
POWER SUPPLY RECTIFIERS: Silicon.
ALTITUDE: 10,000 feet (3000 meters).
AMBIENT TEMPERATURE RANGE: -20° C to $+45^\circ$ C.
MAXIMUM VSWR: 1.7 to 1.
SIZE: Transmitter cabinet, 42"W (107cm) x 78"H (198cm) x 33"D (84cm).
FRONT DOOR SWING: 21" (53cm).
FINISH: White, blue and black.
WEIGHT AND CUBAGE: Export: 2200 lbs. (998 kg). Domestic: 1800 lbs. (817 kg). 120 cubic feet.

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ± 75 KHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 KHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 KHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 KHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 KHz/15 KHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 KHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 50 dB below reference carrier AM modulation 100% output power.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: $+10$ dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 KHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: .2%, 30 Hz to 15 KHz de-emphasized.
INTERMODULATION DISTORTION: .1%, 60 Hz/7 KHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 KHz/15 KHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 KHz deviation, measured 20 Hz to 200 KHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).

AUDIO INPUT IMPEDANCE: Left and Right channels; 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
AUDIO INPUT LEVEL: $+10$ dBm, ± 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and Right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 KHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 KHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1%, 60 Hz/7 KHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 80 dB (reference 14 KHz/15 KHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 KHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -50 dB.
NON-LINEAR CROSSTALK: -60 dB.
76KHZ SUPPRESSION: -68 dB.
38 KHZ SUPPRESSION: -73 dB.
FM NOISE: (Left or right) 70 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 KHz deviation, measured 30 Hz to 15 KHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 KHz ± 1 Hz, 0° to 50° C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right) - remoteable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 41 or 67 KHz programmable, any frequency between 25 and 75 KHz on special order.
FREQUENCY STABILITY: ± 500 Hz.
MODULATION CAPABILITY: ± 7.5 kHz.
AUDIO FREQUENCY RESPONSE: 41 KHz and 67 KHz coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 KHz ± 0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: $+10$ dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 KHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 KHz standard. 3 KHz, 5 KHz, 7.5 KHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 40-4,500 Hz ± 5 KHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 KHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = ± 5 KHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel): -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA): 55 dB below ± 5 KHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 KHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 KHz/67 KHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Specifications subject to change without notice.

ORDERING INFORMATION

FM-10K, 10,000 watt FM transmitter with MX-15 exciter, for wideband operation, 60 Hz.	994-8051-005
As above, except for 50 Hz operation	994-8051-006
Mono generator (add for mono operation)	994-8019-001
DSM stereo generator with DTR (add for stereo operation)	994-8020-001
SCA generator (add for SCA operation, specify 41 or 67 kHz)	994-7992-001

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P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200



HARRIS

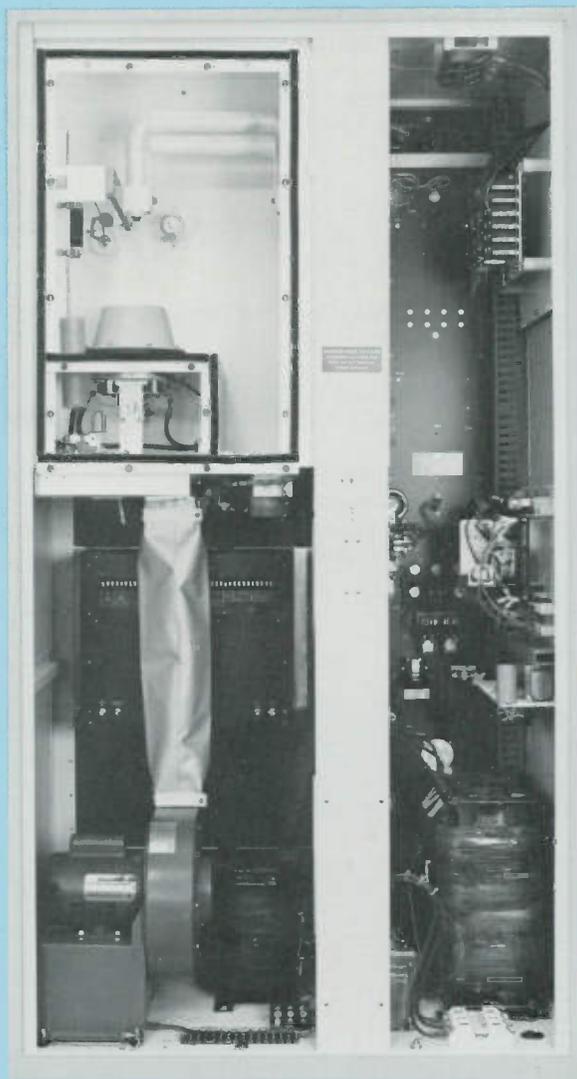
FM-5K

5-Kilowatt
FM Broadcast
Transmitter

- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Digitally Synthesized Modulation stereo generator yields 48 dB minimum separation for increased stereo realism
- Dynamic Transient Response (DTR*) stereo generator filter maximizes modulation level without overmodulating
- Stable "Vari-Line" output tuning requires fewer adjustments
- Standard VSWR protection provides fault protection to antenna and transmission line equipment
- Convenient operation—full metering, status lights and remote control termination are just a few of the standard features which minimize maintenance and installation time

*Patented





Featuring the advanced-design MX-15 exciter, the Harris 5 kW FM-5K provides the cleanest and the loudest stereo signal of any FM transmitter in its power range. The DSM (Digitally Synthesized Modulation) stereo generator allows the transmitter to provide stereo separation of 50 dB minimum, 30-15,000 Hz—while the DTR (Dynamic Transient Response) filter permits a 2 to 6 dB increase in loudness, with no degradation of audio quality, by limiting overshoot to 2% or less. Add to this high efficiency plus conservatively rated components and you have a truly exceptional FM transmitter.

ONLY TWO TUBES. Just two tubes are employed in the transmitter. A type 4CX-250B tube amplifies the solid-state exciter output and supplies a nominal 250 watts to drive the ceramic 4CX5000A final amplifier. This power tetrode operates as a single ended amplifier to produce 5 kilowatts of RF power.

"VARI-LINE" SILVER PLATED TANK. Vari-Line is a Harris-developed method of

tuning a single-ended FM amplifier for optimum output efficiency. A portion of a parallel tubular 1 $\frac{1}{8}$ inch copper transmission line (silver plated for efficient RF service) is made variable in order to inductively tune the line to operating frequency.

AUTOMATIC RECYCLING. In case of momentary overload, recycling takes place automatically. Should an overload reoccur in excess of the number of times preset, the transmitter will then remain off the air until it is reset, either locally or by remote control.

VSWR PROTECTION. To protect the transmitter PA, a VSWR overload circuit has been incorporated. The VSWR circuit monitors the reflected power from the output directional coupler and interrupts the high voltage power supply when the VSWR exceeds a pre-determined level. The transmitter will attempt to restart, and if the VSWR clears, return to air. Multiple VSWR trips within a given period will cause the transmitter to shutdown.

HV POWER SUPPLY. All power supplies are housed inside the transmitter cabinet. One three-phase supply provides the PA plate voltage, and powers the IPA plate and screen circuits. The transmitter employs a special power supply protective circuit to assure maximum protection from transient voltages or on-off power surges.

REMOTE CONTROL. The FM-5K features built-in remote metering for the plate voltage, plate current and power output. No interface components are required to adapt a Harris remote control system to the transmitter. The transmitter's remote control circuitry can also be interfaced easily to other manufacturers' remote systems.

TESTING. Environmental tests, in conditions surpassing those of any location a transmitter is likely to encounter, have been imposed on the FM-5K. The transmitter is capable of operating at altitudes up to 7,500 feet (2250 meters), in an ambient temperature range of -20° to +45° C.

In addition, your transmitter is fully tuned and operationally tested on your frequency before shipment.

METERING AND VISUAL AIDS. Six meters, including four large, front-panel meters, provide full monitoring of the transmitter's operating parameters. Included is a power indicator that permits direct reading of both power output and standing wave ratio. To aid in fault location, a system of indicator lights provides status display of important transmitter parameters to minimize service time.

MORE FEATURES. There are many other operational and convenience features incorporated into the FM-5K transmitter. These include:

- Pushbutton Operation—On-off functions are controlled by lighted pushbuttons at the top left of the transmitter. These are clearly marked "Filament On-Off", "Plate On-Off".
- High-Capacity Blower—backed up by a precision air-pressure switch gives complete protection to the IPA and PA tubes.
- Straightforward Design—allows easy accessibility to all components.
- AC Interruption Restart—this feature provides for automatically returning the transmitter "on air" after a temporary or indefinite outage of the AC power source. A front panel override switch is also provided.
- FCC Type Acceptance—The transmitter is FCC type accepted for mono, stereo and SCA broadcasting in the 87.5 to 108 MHz FM band.

HARRIS MX-15 EXCITER... NEW LEVELS OF EXCELLENCE IN FM AUDIO PERFORMANCE

Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO. The unique VCO (Voltage Controlled Oscillator) of the MX-15 features outstanding linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an extremely low .02%, with all CCIF intermodulation distortion products down at least 80 dB as measured through the FM-5K. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ± 100 kHz.

Equally impressive is the FM-5K/MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the exciter and transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT. Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the probability of ground loops and other system interface problems.

DIGITAL SYNTHESIZER. The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct frequency comparison against WWV transmissions. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 KHz increments. The dual-state AFC will acquire the VCO over a ± 10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.



DIGITALLY SYNTHESIZED MODULATION. The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Separation through the FM-5K readily exceeds an impressive 48 dB specification over the 30-15,000 Hz range.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION. A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION. Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television

or other critical data signals. Stations programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER. The MX-15 power amplifier module is solid-state, conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING. Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL EXCITER FEATURES. The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used directly, without interface, with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadraphonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.

FM-5K SPECIFICATIONS

GENERAL

POWER OUTPUT: 1.0 to 5.1 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 3/8" EIA flange.
FREQUENCY STABILITY: ± 300 Hz 0° to 45° C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation.
MODULATION CAPABILITY: ± 100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 60 Hz (50 Hz available.) Power consumption (approx.): 10 kW consumption at 5 kW output. 115/230 V, 60 or 50 Hz, 150 watts for MX-15.
RF HARMONICS: Suppression meets all FCC requirements.
POWER SUPPLY RECTIFIERS: Silicon.
ALTITUDE: 7,500 feet (2250 meters).
AMBIENT TEMPERATURE RANGE: -20° C to $+45^\circ$ C.
MAXIMUM VSWR: 1.7 to 1.
SIZE: Transmitter cabinet, 42"W (107cm) x 78"H (198cm) x 33"D (84cm).
FRONT DOOR SWING: 21" (53cm).
FINISH: White, blue and black.
WEIGHT AND CUBAGE: Export: 2100 lbs. (953 kg). Domestic: 1700 lbs. (771 kg). 120 cubic feet.

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ± 75 KHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 KHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 KHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 KHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 KHz/15 KHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 KHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 50 dB below reference carrier AM modulation 100% output power: 15 watts.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 KHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 KHz de-emphasized.
INTERMODULATION DISTORTION: .15%, 60 Hz/7 KHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 KHz/15 KHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 KHz deviation, measured 20 Hz to 200 KHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).

AUDIO INPUT IMPEDANCE: Left and Right channels; 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
AUDIO INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and Right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 KHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 KHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1%, 60 Hz/7 KHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 80 dB (reference 14 KHz/15 KHz test tone pair).
STEREO SEPARATION: 48 dB, 30 Hz-15 KHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -50 dB.
NON-LINEAR CROSSTALK: -60 dB.
76KHZ SUPPRESSION: -68 dB.
38 KHZ SUPPRESSION: -73 dB.
FM NOISE: (Left or right) 74 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 KHz deviation, measured 30 Hz to 15 KHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 KHz ± 1 Hz, 0° to 50° C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right) - remoteable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 41 or 67 KHz programmable, any frequency between 25 and 75 KHz on special order.
FREQUENCY STABILITY: ± 500 Hz.
MODULATION CAPABILITY: ± 7.5 kHz.
AUDIO FREQUENCY RESPONSE: 41 KHz and 67 KHz AC coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 KHz ± 0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 KHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 KHz standard. 3 KHz, 5 KHz, 7.5 KHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ± 5 KHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 KHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = ± 5 KHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel): -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA): 55 dB below ± 5 KHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 KHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (41 KHz/67 KHz) 50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Specifications subject to change without notice.

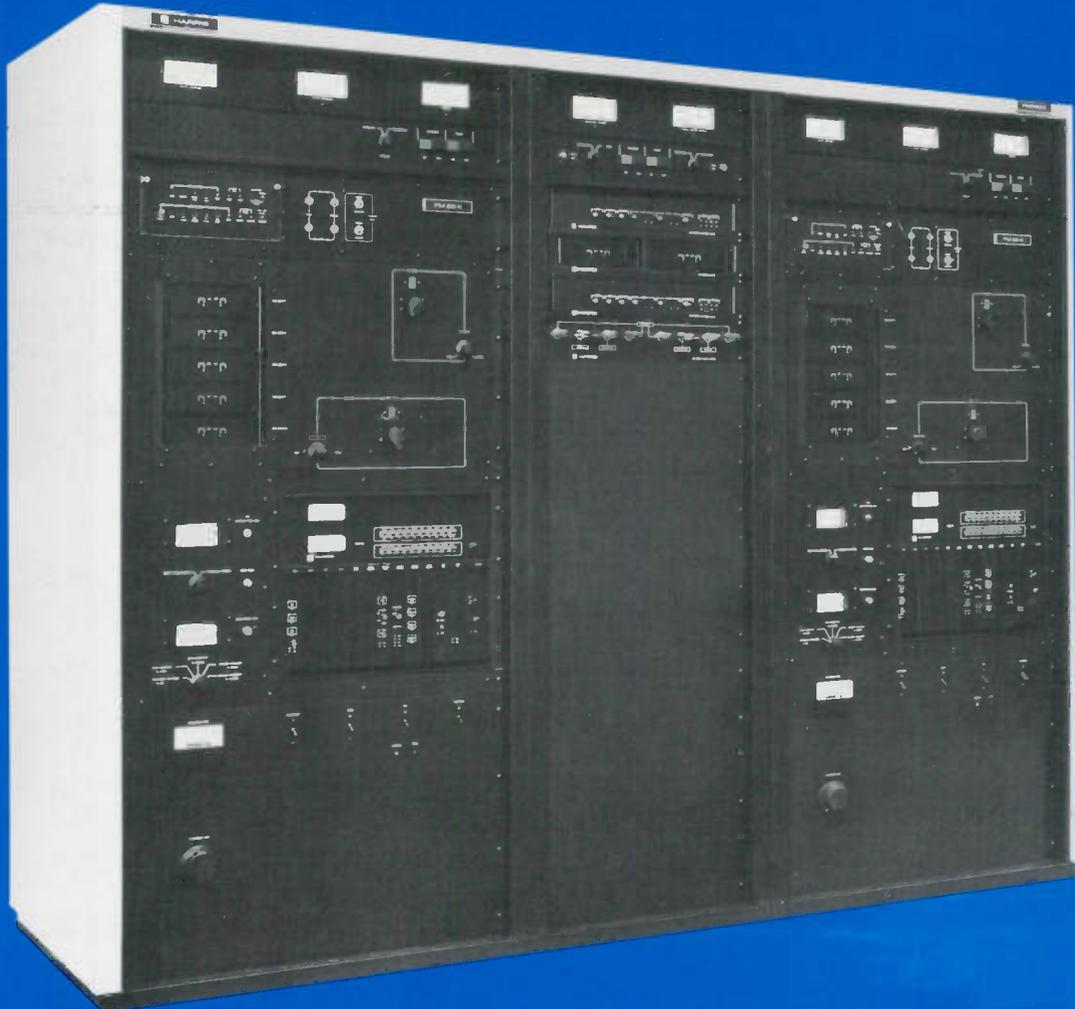
ORDERING INFORMATION

FM-5K, 5 kW FM transmitter with MX-15 exciter, for wideband operation, 60 Hz.	994-8049-003
As above, except for 50 Hz operation	994-8049-006
Mono generator (add for mono operation)	994-8019-001
DSM stereo generator with DTR (add for stereo operation)	994-8020-001
SCA generator (add for SCA operation, specify 41 or 67 kHz)	994-7992-001

HARRIS CORPORATION BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

FMD-50K

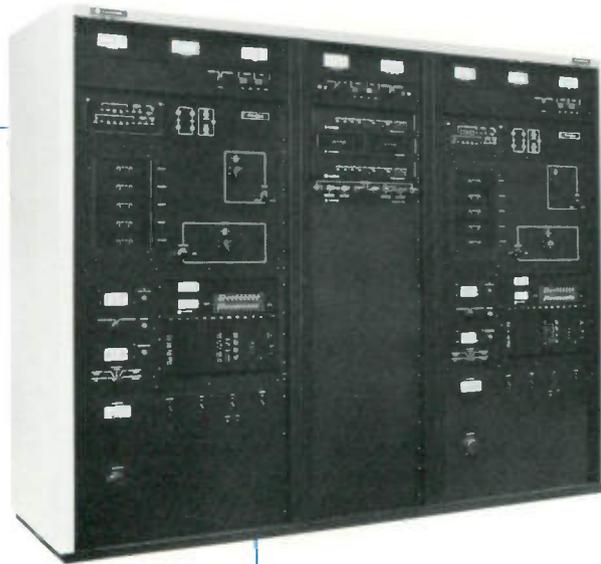
**50-kilowatt dual FM
broadcast transmitter**



HARRIS FMD-50K ... DUAL CONFIGURATION FOR COMPLETE REDUNDANCY ... ONLY TWO TUBES

- MX-15 Exciter with ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Combines two 25-kilowatt amplifiers for highest on-air reliability
- Only *two* low stress PA tubes, yielding low operating cost and long tube life
- Wide RF bandwidth for maximum stereo and SCA performance
- Solid-state control logic and automatic power control minimize adjustments
- Digitally Synthesized Modulation stereo generator provides 50 dB minimum separation for increased stereo realism
- Dynamic Transient Response (DTR*) overshoot filter maximizes modulation level

*Patented



The FMD-50K dual 50-kilowatt transmitter offers real protection against off-air time through redundancy, and through extensive use of solid-state circuitry. Only two tubes are employed in the entire FMD-50K... high-gain, highly efficient 8990 tetrodes used as the final power amplifiers. The 8990 uses a wavy fin radiator which provides exceptional cooling at reduced air requirements, for quiet operation. The quarter-wave PA cavity design eliminates troublesome sliding contacts for tuning, and assures wide RF bandwidth. This results in a signal path that is transparent to the MX-15 exciter.

The **basic** FMD-50K transmitter consists of two 25-kilowatt amplifiers, and a center control cabinet. It provides redundancy in all areas except the exciters. In case emergency operation is required, you stay on the air at one-quarter normal power output. An even higher level of redundancy is achieved in the **complete** FMD-50K through an optional arrangement of switches, sensors and circuits that make the FMD-50K totally redundant from audio input to RF output.

The FMD-50K with the RF output switching option provides the capability of automati-

cally switching either transmitter directly to the antenna, thus providing one-half normal operating power in the event of a transmitter malfunction.

With the addition of the automatic exciter switching option, automatic backup exciter protection is provided. Also, an optional RF input patch panel is available to connect either exciter directly to either transmitter by bypassing all of the automatic exciter switching equipment.

SOLID-STATE IPA'S

The redundancy of the dual FMD-50K is heightened when the IPA in each 25-kilowatt amplifier is considered. The IPA stages are multiple solid-state amplifiers combined in such a manner that failure of one amplifier stage will not cause a total loss of IPA RF power. The IPA solid-state modules in the PA are identical to those used in the booster amplifier for the MX-15. The wide use of solid-state RF power circuits means that the FMD-50K uses only two tubes.

LOW OPERATING COST

With today's mounting energy costs, transmitter efficiency must be a major consideration in any purchase. 77% efficiency in

the final power amplifiers, high efficiency in all amplifier circuits, and conservatively rated components result in comparatively low power consumption and low operating stress on heat generating components in the FMD-50K. This adds up to very impressive savings in operating and maintenance costs.

FINEST STEREO PERFORMANCE

Featuring the advanced-design MX-15 exciter, Harris' FMD-50K provides the cleanest and the loudest stereo signal of any 50-kilowatt FM transmitter available today. The DSM (Digitally Synthesized Modulation) stereo generator allows the transmitter to provide stereo separation of 50 dB minimum (60 dB typical midband), 30-15,000 Hz—while the DTR (Dynamic Transient Response) filter permits a 2 to 6 dB increase in loudness, with no degradation of audio quality, by limiting overshoot to 2% or less.

The FMD-50K may be equipped for mono or stereo operation, with or without SCA. The design versatility of the MX-15 exciter allows you to order mono operation originally, then add stereo and/or SCA at a later date by plugging the appropriate module(s) into the exciter. The FMD-50K is equipped for wideband composite input in its standard configuration.

AUTOMATIC POWER CONTROL

The FMD-50K automatically monitors power output, and maintains the output at the desired level. This standard feature insures against out-of-tolerance power conditions. Furthermore, the power set point can be remotely adjusted independently of the limit points to allow operator control of

power output. During maintenance periods, the automatic power control may be switched off.

VSWR PROTECTION

VSWR protection is mandatory in any high-power transmitter—therefore, Harris has incorporated this as a standard feature in the FMD-50K. A high VSWR condition will cause the transmitter to recycle...if three overloads occur within a given time period, the transmitter will shut down until manually restarted. The transmitter may also be programmed for single VSWR overload shutdown.

CONTROL CIRCUITRY

The FMD-50K is controlled by solid-state logic circuitry. The logic circuitry not only controls basic On/Off functions, but also monitors critical stages for overload conditions. Should an overload occur, the transmitter will recycle automatically.

The control logic used in the FMD-50K interfaces directly with most remote control systems, eliminating the need for an additional remote control interface. The control signals are momentary low current contacts. The transmitter output parameters are buffered, and all status indicators can be removed.

METERING AND VISUAL AIDS

Major functions, including combined output power, VSWR and reject load power are displayed on easy-to-read 4-inch meters in the center cabinet. Complete monitoring of operating functions of the individual 25-kilowatt amplifiers is also displayed. Low-level parameters of each amplifier are displayed on a multimeter, and IPA RF output and reflected power are indicated on another meter. Filament voltage is measured by a true RMS circuit.

The FMD-50K provides a variety of indicators as troubleshooting aids and quick references. These include illuminated On/Off pushbuttons and numerous LED status indicators.

HV POWER SUPPLIES

The two high voltage power supplies are housed in separate cabinets, and provide the plate and screen voltage. The conservatively-rated three-phase plate supplies use silicon rectifiers with AC line transient protection.

COMPACT SIZE

The trim FMD-50K cabinet configuration measures only 90.2" wide, 72" high and

30.5" deep. Additionally, the HV power supplies may be located in any convenient spots remote from the PA cabinets.

GENERAL

There are many other operational and convenience features incorporated into the FMD-50K. These include:

Line Loss Protection—Built-in protection against total AC failure and loss of phase is provided. The FMD-50K will restart automatically following a total power failure, while loss of a single phase will shut down the transmitter.

High Altitude Rating—High capacity, direct-drive blowers deliver sufficient air to cool the transmitter at altitudes up to 10,000 feet (3048 meters).

Additional Protection—Magnetic circuit breakers are utilized to protect the blower motors, the filament supplies, the IPA supplies and the bias supplies. A safety interlock system and a drop solenoid system discharge power supplies to safe levels.

Automatic Transmitter System Compatibility—The simple control logic interface and full metering in the FMD-50K permit ATS operation.

HARRIS' FMD-50K DUAL FM TRANSMITTER CONFIGURATIONS

BASIC FMD-50K DUAL SYSTEM

- Two FM-25K transmitters, less exciter.
- One MX-15 exciter.
- One dual RF booster amplifier with low power hybrid coupler and reject load.
- One 19-inch center cabinet with control and metering circuitry.
- One high power hybrid coupler with interconnecting transmission line components.
- One 12.5-kilowatt reject load.

FMD-50K WITH AUTOMATIC RF OUTPUT SWITCHING

- Two FM-25K transmitters, less exciter.

- One MX-15 exciter.
- One dual RF booster amplifier with low power hybrid coupler and reject load.
- One 19-inch center cabinet with control metering and RF control logic assembly.
- One floor-mounted frame assembly with three high power coaxial switches, one high power hybrid combiner, and one 12.5-kilowatt reject load.
- All necessary interconnecting transmission line components.

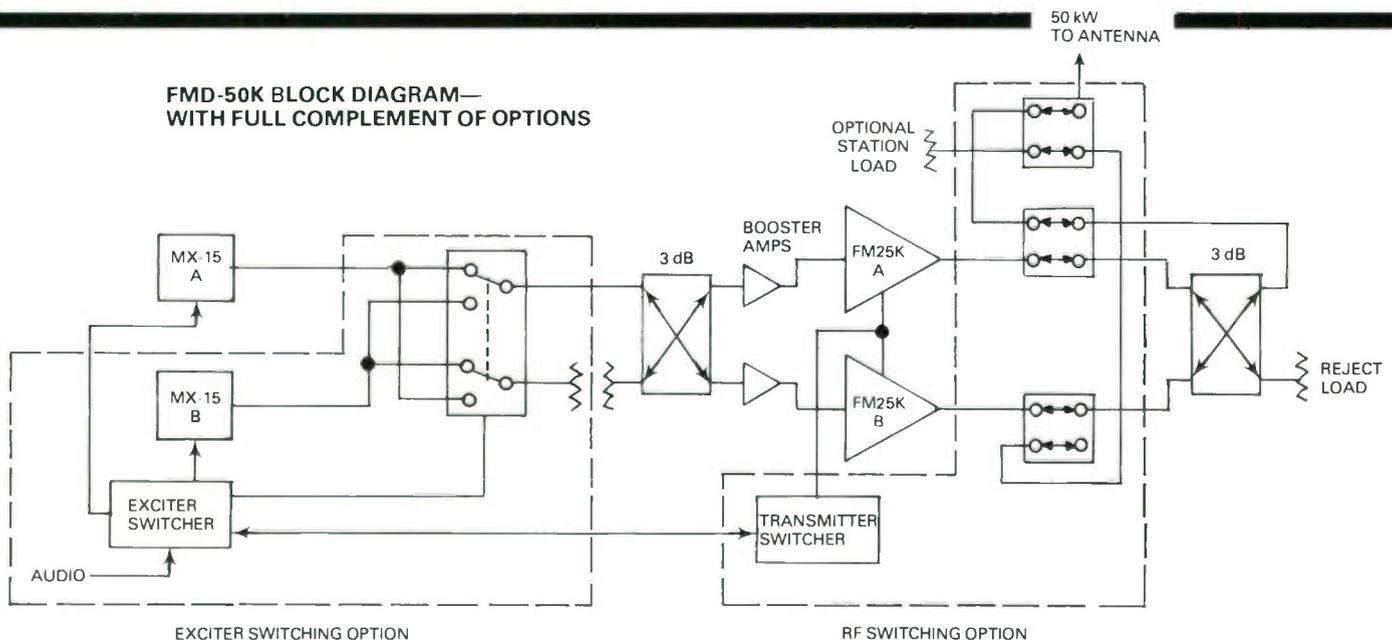
OPTIONAL AUTOMATIC EXCITER SWITCHING

- One automatic RF control logic assembly.

- One coaxial transfer switch.
- One test load for exciter.
- All necessary cabling for system interconnect.
- (Requires second exciter, which is not included in this option package).

ADDITIONAL OPTIONS FOR FMD-50K

- Mono generator(s).
- Stereo generator(s).
- SCA generator(s).
- RF input manual patch panel for use with exciter switching option.



FMD-50K SPECIFICATIONS

GENERAL

POWER OUTPUT: 20 kW to 50 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency. Exciter programmable in 50 kHz increments.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 6 $\frac{1}{8}$ " EIA flange.
FREQUENCY STABILITY: ± 300 Hz 0° to 45°C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation.
MODULATION CAPABILITY: ± 100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 50/60 Hz. 360/415 V, 3-phase, 50/60 Hz. Power consumption: 80,000 watts (approx.).
RF HARMONICS: Suppression meets all FCC requirements.
ALTITUDE: 10,000 feet (3048 meters).
AMBIENT TEMPERATURE: -20°C to +50°C.
MAXIMUM VSWR: 1.7 to 1.
SIZE: Transmitter: 90.2"W (229 cm) \times 72"H (183 cm) \times 30.5"D (77.5 cm). HV power supply cabinets: (each) 48"W (122 cm) \times 60.2"H (153 cm) \times 24.2"D (61.5 cm).
FINISH: White, blue and black.
WEIGHT AND CUBAGE (Approximate): Export: 7000 lbs. (3178 kg). Domestic: 6800 lbs. (3087 kg). Cubage: 400 cubic feet (11.3 cubic meters).

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volts RMS nominal for ± 75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 55 dB below referenced carrier AM modulation 100% output power.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
AUDIO INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation.

AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.12% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 75 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -50 dB.
NON-LINEAR CROSSTALK: -60 dB.
76 kHz SUPPRESSION: -68 dB.
38 kHz SUPPRESSION: -73 dB.
FM NOISE: (Left or right) -72 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ± 1 Hz 0° to 50°C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right) — remoteable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 67 kHz or 92 kHz programmable, any other frequency between 25 and 75 kHz on special order.
FREQUENCY STABILITY: ± 500 Hz.
MODULATION CAPABILITY: ± 7.5 kHz.
AUDIO FREQUENCY RESPONSE: 67 kHz and 92 kHz AC coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ± 0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ± 5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = ± 5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) ~ 60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ± 5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (67 kHz/92 kHz) -50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

HARRIS MAINTAINS A POLICY OF CONTINUOUS PRODUCT IMPROVEMENT, AND THEREFORE RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

ORDERING INFORMATION

FMD-50K, dual 50-kilowatt FM transmitter, with automatic RF output switching, for wideband operation	994-8455-003
FMD-50K, dual 50-kilowatt FM transmitter, basic system, for wideband operation	994-8455-004
Automatic exciter switching option (does not include second exciter)	994-8456-001
MX-15 exciter (does not include generator modules)	994-7950-004
Monaural generator (add for mono operation)	994-8019-001
DSM stereo generator with DTR (add for stereo operation)	994-8020-001
SCA generator (add for SCA operation, specify 67 or 92 kHz)	994-7992-002
RF input patch panel	994-8473-001

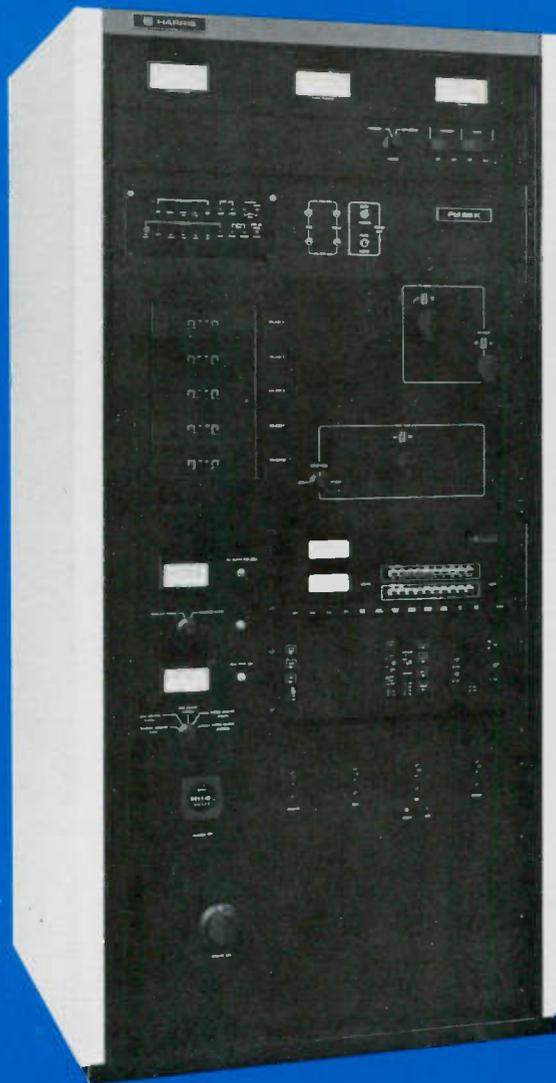
HARRIS CORPORATION BROADCAST TRANSMISSION DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200



HARRIS

FM-25K

25-Kilowatt
FM Broadcast
Transmitter



- Advanced single tube design offers maximum reliability
- MX-15 Exciter features ultra linear modulated oscillator for minimum distortion, maximum signal clarity
- Solid state RF driver with built-in backup protection helps minimize down time
- Wide RF system bandwidth guarantees exceptional stereo and expanded SCA channel performance
- Automatic power control eliminates routine operator adjustment
- Automatic VSWR Foldback safely keeps station on the air despite heavy antenna icing condition
- Quarter wave PA cavity has no troublesome fingerstock at high current points
- Composite input standard. Optional high performance mono, stereo, and SCA generation available

Harris' technology has combined advances in both tube and transistor designs, to bring you a major step forward in high-power FM transmitters. Transistors are now available which provide 50 watts of RF power at reasonable gain and low junction temperatures. By combining several of these transistors in wideband RF circuits, enough power can be generated to drive an advanced high-gain Eimac tetrode tube, the 4CX20,000A. This tube, when grid driven in a grounded cathode, quarter-wave cavity, can produce 25 kilowatts with 350 watts of drive at nearly 80% plate efficiency!

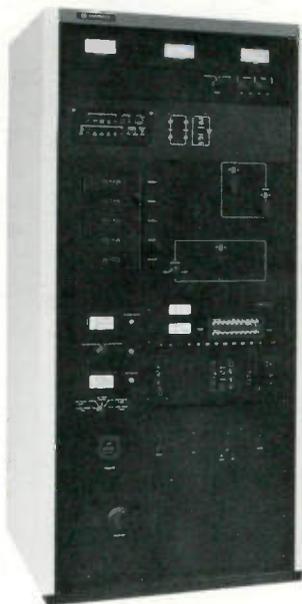
The FM-25K, twenty-five kilowatt FM transmitter reflects Harris' design philosophy that FM transmitters should deliver RF power efficiently, should not limit exciter performance, and should integrate dependable solid-state control logic. In the FM-25K, these features are teamed with efficient, single-tube design, and with the high performance MX-15 exciter.

The FM-25K was designed for applications with tower limitations or specific coverage requirements. The higher RF power output reduces the number of antenna bays required for a given ERP; and fewer bays mean a reduction in windloading and mounting area, so that tower size and/or height may be reduced. Also, fewer antenna bays, with less gain, can mean improved close-in coverage and the elimination of null fills.

SINGLE TUBE DESIGN

The FM-25K was the first high-power FM transmitter to utilize a single-tube design. A high-gain, highly efficient 4CX20,000A tetrode is the only tube in the entire transmitter, and is used as the final power amplifier. The tube uses a wavy fin radiator which

Harris FM-25K...high efficiency...wide RF bandwidth...only one tube



provides exceptional cooling at reduced air requirements, for quiet operation. The quarter-wave PA cavity design eliminates troublesome sliding contacts for tuning, and assures wide RF bandwidth. This results in a signal path that is transparent to the MX-15 Exciter.

SOLID-STATE IPA

Five solid-state power amplifier modules (2 amplifiers per module) are combined to produce 350 watts of drive power, with plenty of reserve. One module functions as the IPA driver, and the other four as driver power amplifiers. All of these modules are identical, so that in case the IPA driver should fail, one of the power amplifier modules may be inserted in its place. Loss of one of the four driver amplifier modules will not result in an off-air condition, as these solid-state amplifiers are isolated from each other. All five solid-state amplifier modules are broadbanded, and require no individual tuning over the entire 88-108 MHz band.

Unlike other FM transmitters that use 90% hybrid networks, the Harris FM-25K IPA section utilizes an "in-phase" power splitting/combining configuration that presents equal loads to each amplifier. This Harris technique minimizes IPA stress to insure reliable operation. The solid-state, modular IPA affords back-up capability for greatly improved reliability, and reduces overall transmitter tuning requirements.

LOW OPERATING COST

With today's mounting energy costs, transmitter efficiency must be a major consideration in any purchase. Efficiency in the final power amplifier circuits is typically 77%. Conservatively rated components re-

sult in comparatively low power consumption and low operating stress on heat generating components in the FM-25K. This adds up to very impressive savings from reduced operating and maintenance costs.

AUTOMATIC POWER CONTROL

The FM-25K automatically monitors RF power output, and maintains the output at the desired level. This standard feature insures against out-of-tolerance power conditions. Furthermore, the power set point can be remotely adjusted independently of the limit points to allow operator control of power output. During maintenance periods, the automatic power control may be switched off.

AUTOMATIC VSWR FOLDBACK AND VSWR PROTECTION

In certain areas, heavy antenna icing conditions occur frequently causing antenna VSWR to increase and transmitters to shut down. Recognizing this, Harris has included as standard equipment a VSWR foldback protection circuit into the FM-25K that permits continued on-air operation at the safest operating power level.

This automatic circuit eliminates the need to call the station's engineer to make drastic reductions in operating power level. This circuit does not simply switch the transmitter to a fixed low power. Instead, it automatically reduces power to a level that permits continued safe operation. Further power reductions are made should the icing condition grow more severe. Likewise, when the ice begins to clear and the antenna VSWR decreases, the FM-25K's output power is automatically increased to the highest level at which the transmitter can be operated until normal operation is restored.

Instantaneous VSWR protection remains standard in the Harris FM-25K. Should the load VSWR increase dramatically, the FM-25K will shut down and automatically recycle on. If the high load VSWR should be detected three times within 30 seconds, the FM-25K will remain off until a manual restart command is received.

The FM-25K's automatic VSWR protection circuit and instantaneous VSWR overload protection are designed to keep your station on the air at the safest operating level.

CONTROL CIRCUITRY

The FM-25K is controlled by solid-state logic circuitry. The logic circuitry not only controls basic On/Off functions, but also monitors critical stages for overload conditions. Should an overload occur, the transmitter will recycle automatically, according

to the number of times pre-set (one or three).

The control logic used in the FM-25K interfaces directly with most remote control systems, eliminating the need for an additional remote control interface. The control signals are momentary low current contact closures. The transmitter output parameters are buffered, and all status indicators are remoted. This FM-25K feature allows stations to remote a wealth of diagnostic information to the remote control point.

METERING AND VISUAL AIDS

Major functions, including RF output, VSWR and PA parameters are displayed on easy-to-read four-inch meters. Low-level parameters are displayed on two multi-meters. IPA RF output and reflected power are indicated on another meter. Filament voltage is measured by a true RMS circuit to help achieve long tube life. The FM-25K provides a variety of indicators as trouble shooting aids and quick references. These include four illuminated On/Off pushbuttons and 26 LEDs, not including those on the MX-15 Exciter.

HV POWER SUPPLY

The high voltage power supply is housed in a separate cabinet, and provides the plate and screen supplies. The conservatively rated three-phase plate supply uses silicon rectifiers with AC line transient protection.

COMPACT SIZE

The trim PA cabinet can fit as a replacement for most older 20- to 25-kilowatt transmitters. The cabinet is only 35 inches wide, 72 inches high and 31 inches deep. Additionally, the HV power supply may be located in any convenient spot remote from the PA cabinet.

ADDITIONAL FEATURES

There are many other standard operational and convenience features incorporated into the FM-25K. These include:

Line loss protection—built-in protection against total AC failure and loss of phase is provided. The FM-25K will restart automatically following a total power failure, while loss of a single phase will shut down the transmitter.

High altitude rating—a high capacity, direct-drive blower delivers sufficient air to cool the transmitter at altitudes up to 10,000 feet (3048 meters).

Additional protection—four magnetic circuit breakers are utilized to protect the blower motor, the filament supply, the IPA supply and the bias supply. A wide-ranging interlock system and a drop solenoid system quickly discharge power supplies to safe levels.

ATS compatibility—the simple control logic interface and full metering in the FM-25K permit ATS operation.

Harris MX-15 Exciter . . . new levels of excellence in FM audio performance

Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low .02%, with all CCIF Intermodulation distortion products below 80 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ± 100 kHz.

Equally impressive is the FM-25K/MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

DIGITAL SYNTHESIZER

The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison against WWV transmissions. The synthesizer can be easily programmed to any carrier frequency in the 87.5 to 108 MHz band in 50 kHz increments. The dual-state AFC will acquire the VCO over a ± 10 MHz range in a maximum of five seconds, starting from an unlocked condition. Once locked, the AFC passband is narrowed, maximizing FM signal to noise.



DIGITALLY SYNTHESIZED MODULATION

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Stereo separation typically exceeds 50 dB from 30 to 15,000 Hz.

Digital circuitry employed in the generation of the DSM signal lends itself to a minimum of adjustments. These are relatively non-critical in nature and easily maintained year after year. The Harris patented automatic pilot phasing control in the DSM stereo generator makes it virtually impossible to misadjust this critical parameter.

OVERSHOOT COMPENSATION

A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

SCA OPERATION

Not only does the MX-15 Exciter's SCA operation match its other high technology features, it also provides automatic composite level adjustment. For stations utilizing the SCA channel for only part of the broadcast day, the automatic composite level adjustment allows maximum main channel modulation continuously. Here's how: When the SCA generator is activated, the composite level is automatically dropped to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation headroom when the SCA is not used continuously.

The MX-15 Exciter's SCA generator is also equipped with a DC coupled input that minimizes distortion to slow-scan television or other critical data signals. Stations

programming voice or music SCA services will find the programmable audio input low pass filter accommodating to their operational needs.

POWER AMPLIFIER

The power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL BENEFITS

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

The exciter is configured to accept a plug-in quadrasonic FM generator, and provides metering of Left Rear and Right Rear audio inputs.

FM-25K TRANSMITTER SPECIFICATIONS

GENERAL

POWER OUTPUT: 10 kW to 25 kW.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency. Exciter programmable in 50 kHz increments.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 3/4" EIA flange.
FREQUENCY STABILITY: ± 300 Hz 0° to 45° C TXCO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation.
MODULATION CAPABILITY: ± 100 kHz.
AC INPUT POWER: 208/240 V, 3-phase, 50/60 Hz and 360/415 V, 3 phase, 50/60 Hz, 4-wire. Power consumption: 40 kW typical.
RF HARMONICS: Suppression meets all FCC requirements.
ALTITUDE: 10,000 feet (3048 meters).
AMBIENT TEMPERATURE RANGE: -20°C to $+50^\circ\text{C}$. Maximum temperature 50°C @ sea level, decreasing 2°C per 1000 feet (305 meters) to 30°C maximum at 10,000 feet (3048 meters).
MAXIMUM VSWR: 1.7 to 1.
SIZE: Transmitter cabinet, 34.6" W (87.8 cm) \times 71.7" H (182.1 cm) \times 31.0" D (78.7 cm). HV power supply cabinet: 48.0" W (121.9 cm) \times 60.2" H (152.9 cm) \times 24.2" D (61.5 cm).
FINISH: White, blue and black.
WEIGHT & CUBAGE: (Estimated) Export: 3000 lbs. (1361 kg). Domestic: 2700 lbs. (1225 kg). Cubage: 150 cubic feet.

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ± 75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 55 dB below reference carrier AM modulation 100% output power.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.12% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 75 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -50 dB.
NON-LINEAR CROSSTALK: -60 dB.
76 kHz SUPPRESSION: -68 dB.
38 kHz SUPPRESSION: -73 dB.
FM NOISE: (Left or right) 72 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ± 1 Hz 0° to 50° C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—remoteable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 67 or 92 kHz programmable, any frequency between 25 and 92 kHz on special order.
FREQUENCY STABILITY: ± 50 Hz.
MODULATION CAPABILITY: ± 7.5 kHz.
AUDIO FREQUENCY RESPONSE: 67 kHz and 92 kHz AC coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ± 0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ± 5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = ± 5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ± 5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (67 kHz/92 kHz) -50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).
CARRIER MUTE DECAY: Greater than 30 milliseconds.

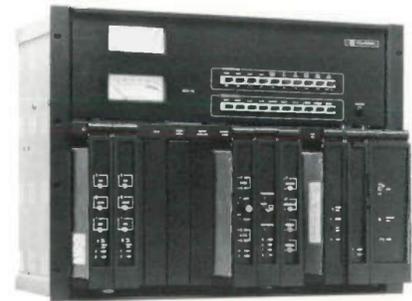
Specifications subject to change without notice.

ORDERING INFORMATION

FM-25K 25,000 watt FM broadcast transmitter with MX-15 exciter, for wideband operation, 50/60 Hz (Specify 50 or 60 Hz)	994-8258-003
Spare tube	374-0151-000
Mono generator (add for mono operation)	994-8019-001
DSM stereo generator with DTR (add for stereo operation)	994-8020-001
SCA generator (add for SCA operation, specify 67 or 92 kHz)	994-7992-002
Extended Control Panel for FM-25K	994-8475-001

HARRIS CORPORATION BROADCAST GROUP
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

Harris MX-15 Exciter . . . new levels of excellence in FM audio performance



Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

Ultra-Linear VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low .02%, with all CCIF Intermodulation distortion products below 80 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slow limited even at maximum modulation capability of ± 100 kHz.

Equally impressive is the FM-3.5K/MX-15's -80 dB FM Signal-to-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

Balanced Floating Composite Input

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

Digital Synthesizer

The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison again WWV transmissions.

Digitally Synthesized Modulation

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Stereo separation typically exceeds 50 dB from 30 to 15,000 Hz.

Overshoot Compensation

A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds

overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

Multipurpose SCA Operation

The MX-15 multipurpose SCA generator is designed to meet the expanded needs of today's SCA service requirements, and is ideal for high quality aural service or for accurate transmission of digital data.

The MX-15 multipurpose SCA generator can be user programmed to operate on 67 kHz or 92 kHz by simply positioning a jumper plug. Other operating frequencies can be easily accommodated upon request. Two SCA generators, one on 67 kHz and the other on 92 kHz, can simultaneously operate with stereo. The MX-15 exciter accommodates additional SCA channels through the composite input.

The transformerless audio input stage improves aural performance in comparison with other designs. Stations will note lower harmonic distortion for improved SCA fidelity.

The transformerless input stage is low pass filtered to meet the technical needs of the SCA information transmitted. A 4.5 kHz low pass response is provided as standard. This can be easily changed for 3 kHz, 5 kHz or 7.5 kHz response, or may be defeated if desired.

The MX-15 multipurpose SCA generator meets the transmission requirements of stations transmitting digital information. A rear mounted BNC input connector DC couples the digital data to the SCA generator's FM modulator for transmission quality.

SCA operators recognize that abrupt muting of the SCA carrier may cause an annoying "pop" in the SCA receivers. Harris has incorporated a carrier mute decay circuit to eliminate this objectionable noise.

In addition to the mute decay circuit, stations may select the mute delay time constant they desire—anywhere between 0.5 seconds and 20 seconds. Automatic mute threshold level can also be adjusted between 0 and -30 dBm in order to meet varying input levels.

The MX-15 exciter and multipurpose SCA

generator work as an effective patented system to automatically maintain maximum main channel modulation at all times. Here's how: When the SCA generator is activated, the composite level is automatically lowered to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation when SCA is not used continuously.

Whether you are planning to use your SCA channel for conventional aural services (such as background music), or are looking at some of the new expanded applications possible today, the Harris MX-15 multipurpose SCA generator meets your needs.

Power Amplifier

The power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

Status and Monitoring

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

Additional Benefits

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

FM-3.5K TRANSMITTER SPECIFICATIONS

GENERAL

POWER OUTPUT: 800 Watts to 4000 Watts.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF LOAD IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 1% EIA flange (female).
FREQUENCY STABILITY: ± 300 Hz 0° to 45° C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation (DCFM).
MODULATION CAPABILITY: 133%.
AC INPUT POWER: 197 thru 250 volts, 60 or 50 Hz, single phase, two wire.
Power Consumption: 7150 watts (approx.) @ 3.5 kW output; 8650 watts (approx.) @ 4 kW output. Power Factor: 0.95 lagging.
RF HARMONICS: Suppression meets all FCC requirements.
ALTITUDE: 10,000 ft./60 Hz, 7500 ft./50 Hz.
AMBIENT TEMPERATURE RANGE: -20° C to $+45^\circ$ C.
MAXIMUM VSWR: 2.0:1.
OVERALL CABINET SIZE: 33"W (84 cm) x 72"H (182 cm) x 34"D (99 cm).
FINISH: White, blue and black.
WEIGHT & CUBAGE: Export: 46.7 cu. ft. (1,322 cu. m); Weight 880 lbs. domestic (400 Kg); 980 lbs. export (445 Kg).

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ± 75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 55 dB below reference carrier AM modulation 100% output power.
SYNCHRONOUS AM SIGNAL TO NOISE: -50 dB.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: .045%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: ± 10 dBm, ± 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 75 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -50 dB.
NON-LINEAR CROSSTALK: -60 dB.
76 kHz SUPPRESSION: -68 dB.
38 kHz SUPPRESSION: -73 dB.
FM NOISE: (Left or right) 72 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ± 1 Hz 0° to 50° C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left)—remoteable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 67 or 92 kHz programmable, any frequency between 25 and 92 kHz on special order.
FREQUENCY STABILITY: ± 500 Hz.
MODULATION CAPABILITY: ± 7.5 kHz.
AUDIO FREQUENCY RESPONSE: 67 kHz and 92 kHz AC coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ± 0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard, 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ± 5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = ± 5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 55 dB below ± 5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz. SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (67 kHz/92 kHz) -50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

HARRIS MAINTAINS A POLICY OF CONTINUOUS IMPROVEMENTS ON ITS EQUIPMENT AND THEREFORE RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

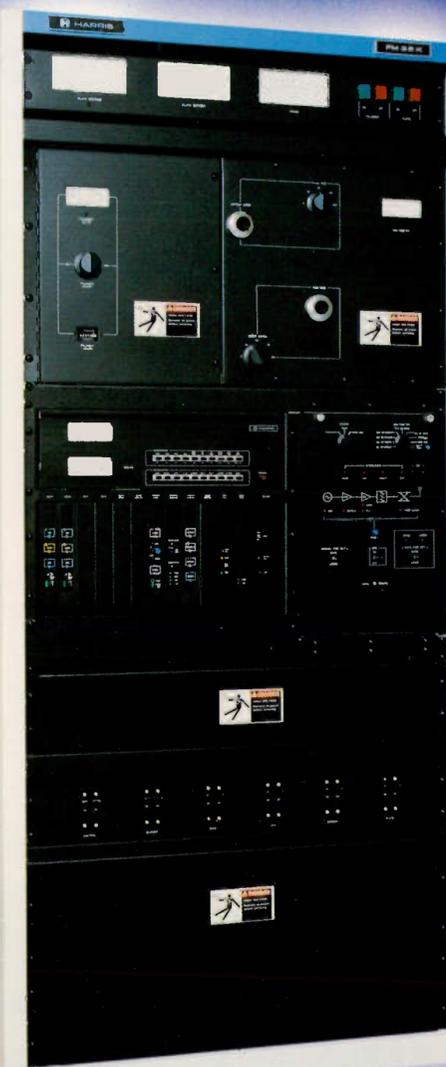
ORDERING INFORMATION

FM-3.5K, 800 to 4000 Watt FM Broadcast Transmitter with MX-15 Exciter for wideband operation, 197 to 250 VAC, Single Phase 50 or 60 Hz (specify)	994-8766-001
Options:	
Constant Voltage Filament Regulator Transformer	472-0586-000 for 60 Hz 472-1244-000 for 50 Hz
Spare 4CX3500A PA Tube	374-0169-000
Mono Generator (Add For Mono Operation)	994-8019-001
Harris DSM Stereo Generator (For Stereo Operation)	994-8020-001
Harris SCA Generator (67 or 92 kHz Operation)	994-7992-002

HARRIS CORPORATION BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200



HARRIS FM-3.5K 800 to 4000 WATT FM BROADCAST TRANSMITTER



The Harris FM-3.5K, 3.5 kW FM broadcast transmitter — even more than you bargained for in a high performance transmitter.

- 800 to 4000 watt output power range
- MX-15 exciter for minimum distortion, maximum signal clarity
- Single phase AC eliminates need for costly 3-phase service
- Automatic power control minimizes operator adjustment
- Automatic VSWR foldback helps keep transmitter on air during antenna icing conditions
- Broadband solid state 150 watt RF driver with **FLEXPatch™** capability
- Front panel block diagram display helps isolate problems, minimizes down time
- Full remote control interface included

When considering 3.5 kW FM transmitters, local service FM broadcasters in general have two major requirements—long term reliability and audio performance. Without question the Harris FM-3.5K meets these crucial requirements and more.

Power To Meet Your Transmission System's Requirement

The Harris FM-3.5K can provide any output power from 800 to 4000 watts. This full range allows you to select the most effective antenna size, tower height and transmission line combination to meet your coverage requirements.

The FM-3.5K consumes only 7 kW of power at 3.5 kW output. Based on an 18

hour broadcast day and a typical power charge of 8¢ per kilowatt hour, this represents an operating cost of only \$10.08 per day.

Even at full 4 kW output, the FM-3.5K requires only single phase AC power. Unlike other transmitters in this power range, there is no need to bring in costly 3-phase AC service to your facility.

Highly Reliable, Long Life Power Amplifier Design

The Harris FM-3.5K utilizes a modern power amplifier chain that provides you with many years of dependable service.

The high performance Harris MX-15 FM

exciter begins the RF chain by delivering 15 watts of power.

The MX-15 is followed by an all solid state 150 watt driver stage which has been specifically designed not to degrade the MX-15's high quality signal. The driver will survive any load condition from opens to shorts. Typically required to produce only 75 watts of drive, the amplifier loads at one-half its power capability. Should servicing ever be required, the driver is housed in a modular enclosure which can be quickly removed.

The long life 4CX3500A power tetrode is especially designed for broadcast service. Harris engineers have designed the PA to

dissipate only 33% of the tube's rated anode capability for long tube life and reliable operation.

Emergency **FLEXPatch™** Capability

Station engineers will appreciate the 50 ohm *FlexPatch* interface used between the exciter, driver, and power amplifier. This Harris feature permits the exciter to be routed directly into the PA, or the IPA to be routed directly into the antenna. *FlexPatch* capability allows you to remain on the air at reduced power should a stage fail. In most instances, reduced power operation will provide you with a surprisingly good signal over your main coverage area.

Bandpass Output Network

Broadcast transmitter locations are growing more congested with other radio services. Therefore, Harris has incorporated a unique bandpass output network into the FM-3.5K to reduce signal interference from other RF services.

Transmitter Control and Status at a Glance

The FM-3.5K's control and status section features a straightforward design that controls and monitors all vital areas to insure top performance. Operators and engineers can determine at a glance the status of the FM-3.5K from its front panel signal path block diagram display. Bright LED indicators signal circuit status in each major

functional stage. These indicators have fault memory in case of power failure.

Station engineers will appreciate the 9-position multimeter that monitors low level stages. A separate true RMS filament voltmeter and front panel control make filament voltage metering and adjustment convenient to optimize tube life.

Automatic Power Control. With a Harris FM-3.5K in service, the need for operator output power adjustments is practically eliminated as its precision automatic power control unit maintains output power to within $\pm 5\%$. Operators will no longer be surprised to find that the station has been operating above or below power for some time due to line voltage fluctuations. The Harris FM-3.5K eliminates this operator concern and constantly maintains authorized power.

Automatic VSWR Foldback. In certain areas, heavy icing conditions occur frequently, often causing antenna VSWR to rise and transmitters to shut down. Recognizing this, Harris engineers have included an automatic VSWR foldback circuit that permits continued safe operation under high VSWR conditions at reduced power. Since this FM-3.5K feature is automatic, there is no need to call the station's engineer to adjust controls or retap transformers. When the VSWR condition clears, normal high power operation is automatically restored.

AC Restart. As momentary power outages are common, the FM-3.5K is equipped with automatic AC restart to immediately return the transmitter to service when power is restored.

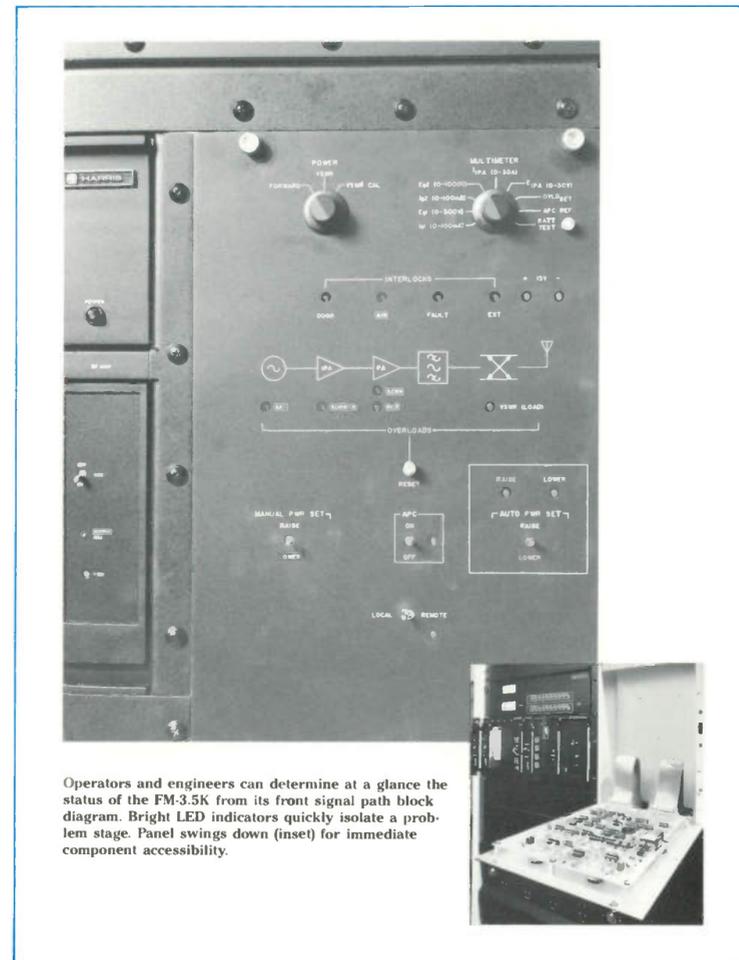
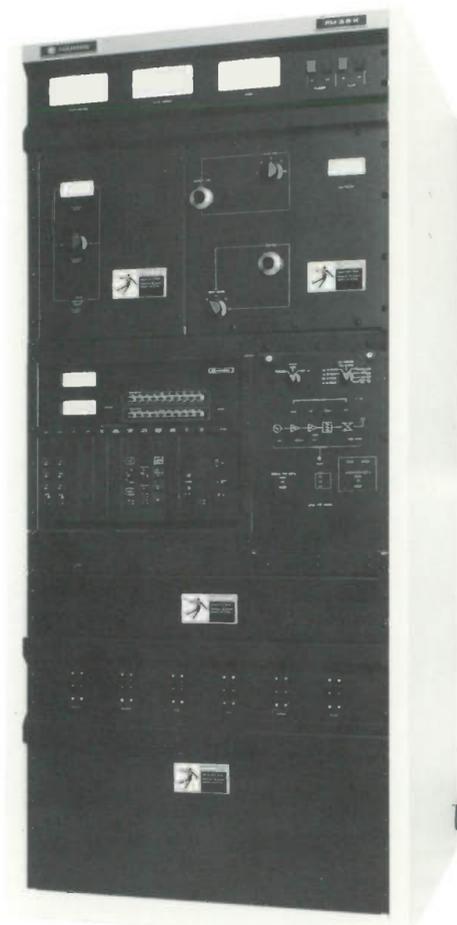
Remote Control Interface Included

Unlike other FM transmitters, remote control interface is an integral part of the FM-3.5K—not an expensive option. Momentary contact closure, suitable for all popular remote control systems, is all that is required for the typical on/off, raise/lower functions. Analog meter samples, along with status lights, are also available for remote control interface.

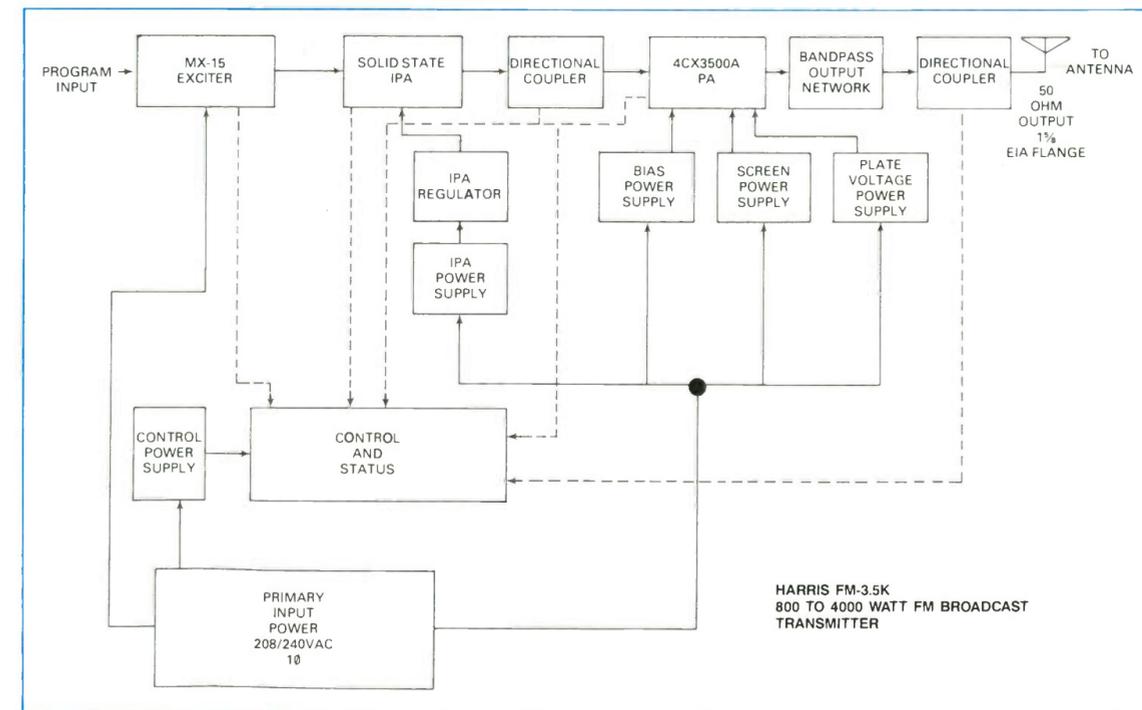
Attention To Details

Quality details have been addressed on every FM-3.5K to minimize potential problems. For example, all plug-in PC boards have gold plated edge connectors to insure the highest contact reliability. All fabricated metal parts are individually treated to protect them from corrosive elements.

These are just a few examples of Harris quality standards at work for you now and for many years to come.



Operators and engineers can determine at a glance the status of the FM-3.5K from its front signal path block diagram. Bright LED indicators quickly isolate a problem stage. Panel swings down (inset) for immediate component accessibility.



Harris MX-15 Exciter . . . new levels of excellence in FM audio performance



Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

Ultra-Linear VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low .02%, with all CCIF Intermodulation distortion products below 80 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ± 100 kHz.

Equally impressive is the FM-25K1/MX-15's -80 dB FM Signal-to-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

Balanced Floating Composite Input

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

Digital Synthesizer

The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison again WWV transmissions.

Digitally Synthesized Modulation

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Stereo separation typically exceeds 50 dB from 30 to 15,000 Hz.

Overshoot Compensation

A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds

overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

Multipurpose SCA Operation

The MX-15 multipurpose SCA generator is designed to meet the expanded needs of today's SCA service requirements, and is ideal for high quality aural service or for accurate transmission of digital data.

The MX-15 multipurpose SCA generator can be user programmed to operate on 67 kHz or 92 kHz by simply positioning a jumper plug. Other operating frequencies can be easily accommodated upon request. Two SCA generators, one on 67 kHz and the other on 92 kHz, can simultaneously operate with stereo. The MX-15 exciter accommodates additional SCA channels through the composite input.

The transformerless audio input stage improves aural performance in comparison with other designs. Stations will note lower harmonic distortion for improved SCA fidelity.

The transformerless input stage is low pass filtered to meet the technical needs of the SCA information transmitted. A 4.5 kHz low pass response is provided as standard. This can be easily changed for 3 kHz, 5 kHz or 7.5 kHz response, or may be defeated if desired.

The MX-15 multipurpose SCA generator meets the transmission requirements of stations transmitting digital information. A rear mounted BNC input connector DC couples the digital data to the SCA generator's FM modulator for transmission quality.

SCA operators recognize that abrupt muting of the SCA carrier may cause an annoying "pop" in the SCA receivers. Harris has incorporated a carrier mute decay circuit to eliminate this objectionable noise.

In addition to the mute decay circuit, stations may select the mute delay time constant they desire—anywhere between 0.5 seconds and 20 seconds. Automatic mute threshold level can also be adjusted between 0 and -30 dBm in order to meet varying input levels.

The MX-15 exciter and multipurpose SCA

generator work as an effective patented system to automatically maintain maximum main channel modulation at all times. Here's how: When the SCA generator is activated, the composite level is automatically lowered to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation when SCA is not used continuously.

Whether you are planning to use your SCA channel for conventional aural services (such as background music), or are looking at some of the new expanded applications possible today, the Harris MX-15 multipurpose SCA generator meets your needs.

Power Amplifier

The power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

Status and Monitoring

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

Additional Benefits

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

FM-25K1 TRANSMITTER SPECIFICATIONS

GENERAL

POWER OUTPUT: 7.35 kW-25 kW (FCC type notified range).
PA EFFICIENCY: Typically 77% or greater at 25 kW
FREQUENCY RANGE: 88 MHz-108 MHz (Tuned to single frequency).
RF LOAD IMPEDANCE: 50 ohm.
RF OUTPUT TERMINATION: 3/4" EIA female flanged.
PA MATCHING RANGE: 1.7:1 VSWR.
RF OUTPUT SPURIOUS AND HARMONIC: Meets or exceeds FCC requirements.

AC LINE VOLTAGE: 210/240 VAC, 50/60 Hz, 3-phase, WYE or closed delta OR 360/415 VAC, 50/60 Hz, 3-phase, 4-wire; line variation (voltage magnitude) $\pm 5\%$ slow.
TRANSFORMER TAPS: 210V, 240V, (VERNIER: -10V, 0V, +10V.)
PRIMARY POWER CONSUMPTION: Typically 40 kW (.95 PF) @ 25 kW.
INLET AIR: PA: 1170 CFM, HVPS 250 CFM.

SIZE AND WEIGHT
MAIN TRANSMITTER CABINET: Height 72 in., Width 33.31 in., Depth 30.18 in., Weight 730 lbs.
HIGH VOLTAGE POWER SUPPLY: Height 60.25 in., Width 48.0 in., Depth 24.13 in., Weight 1405 lbs.
AMBIENT TEMPERATURE: 0°C-50°C.
ALTITUDE: 10,000 ft. maximum, maximum temperature decreases 2°C per 1,000 ft. to 30°C.
HUMIDITY: 0-95% non-condensing.

WIDEBAND COMPOSITE OPERATION
COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ± 75 kHz deviation.

EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs.
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 kHz 1:1 tone pairs).

COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 55 dB below reference carrier with 100% AM modulation @ 400 Hz, 75 microsecond de-emphasis. (No FM modulation present).

SYNCHRONOUS AM SIGNAL TO NOISE: 50 dB below referenced carrier with 100% AM modulation @ 400 Hz, 75 microsecond de-emphasis. (FM modulation ± 75 kHz deviation @ 400 Hz). Measured result may be degraded should the transmitter be operated into a bandwidth restricted antenna system.

MONAURAL OPERATION
AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.

AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25, 50 or 75 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.

INTERMODULATION DISTORTION: 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).

AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
AUDIO INPUT LEVEL: ± 10 dBm, ± 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.

INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.

HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.12% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 75 dB (reference 14 kHz/15 kHz test tone pair).

STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -50 dB.
NON-LINEAR CROSSTALK: -60 dB.

76 kHz SUPPRESSION: -68 dB
38 kHz SUPPRESSION: -73 dB
FM NOISE: (Left or right) 72 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ± 1 Hz 0° to 50°C.

OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—remoteable.
SCA OPERATION
MODULATION: Direct FM.
FREQUENCY OF OPERATION: 67 or 92 kHz programmable, any frequency between 25 and 92 kHz on special order.
FREQUENCY STABILITY: ± 500 Hz.
MODULATION CAPABILITY: ± 7.5 kHz.
AUDIO FREQUENCY RESPONSE: 67 kHz and 92 kHz AC coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ± 0.5 dB.

AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard, 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ± 5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).

FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation ± 5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ± 5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.

CROSSTALK: SCA to SCA (67 kHz/92 kHz) -50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).
CARRIER MUTE DECAY: Greater than 30 milliseconds.

SPECIFICATIONS ARE REFERENCED TO 25 kW OPERATION, EXCEPT WHEN NOTED.

HARRIS MAINTAINS A POLICY OF CONTINUOUS IMPROVEMENTS ON ITS EQUIPMENT AND THEREFORE RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

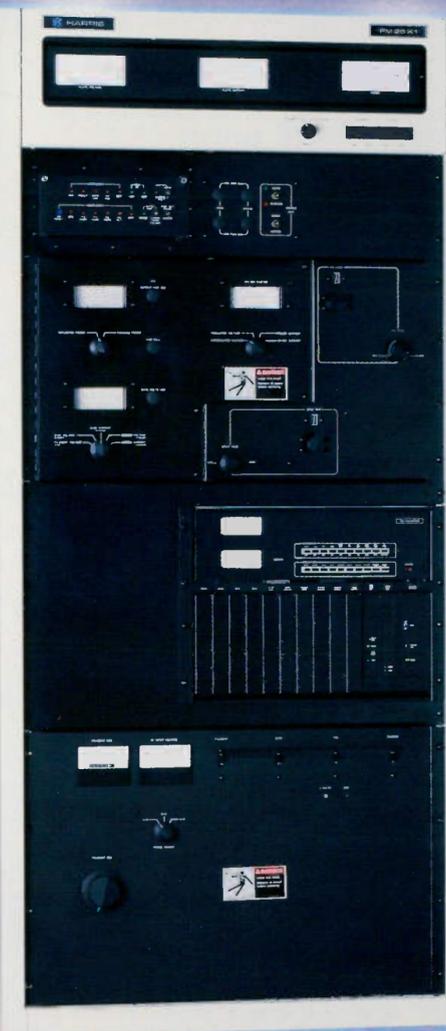
ORDERING INFORMATION

FM-25K1, 25,000 Watt FM Broadcast Transmitter With MX-15 Exciter For Wideband Operation. Specify Carrier Frequency	994-9032-001
And 50 Hz OR 60 Hz AC Operation	374-0151-000
Spare 4CX20,000A Tube	994-8019-001
Mono Generator (Add For Mono Operation)	994-8020-001
DSM Stereo Generator With DTR Filter (Add For Stereo Operation)	994-7992-002
SCA Generator. Specify 67 kHz OR 92 kHz. (Add for SCA Operation)	472-1250-000
Sola Filament Voltage Regulator 60 Hz (Externally Mounted)	

HARRIS CORPORATION BROADCAST DIVISION
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200



HARRIS FM-25K1, 25 kW FM TRANSMITTER



Harris FM-25K1

high efficiency . . . wide RF bandwidth
single tube design

- Single tube, 7 - 25 kW high efficiency, high performance FM transmitter
- Advanced 4CX20,000A PA stage achieves 77% or greater efficiency for low operating costs, longer tube life
- Wide RF bandwidth provides signal transparency to the exciter's audio performance
- Broadband solid state 150 watt RF preamp and 600 watt IPA stages with **FLEXPatch™** capability
- High performance MX-15 exciter for maximum signal clarity
- Automatic VSWR foldback keeps station on the air during antenna icing conditions



The Harris FM-25K1, twenty-five kilowatt broadcast transmitter reflects Harris' design philosophy that FM transmitters should provide maximum signal clarity, operate efficiently, and incorporate the modern technology to practically achieve these goals. The FM-25K1 achieves these goals with the MX-15 FM exciter, followed by a highly efficient, single tube power amplifier.

Power To Meet Your Transmission System Requirements
The Harris FM-25K1 can efficiently provide

any output power from 7.35 kW to 25 kW. This full range allows you to select the best combination of tower height, antenna gain, and transmitter power to accomplish your coverage goals.

Stable, Highly Efficient PA Stage

Every point of PA efficiency improvement represents thousands of kilowatt hours of power saved over a single year. This amounts to thousands of dollars saved in AC power costs during the life cycle of the transmitter. The 77% operating PA efficien-

cy produced by the FM-25K1 yields power cost savings over other designs.

The FM-25K1's high PA efficiency is achieved by using the rugged, long life 4CX20,000A in a wideband, quarterwave cavity. The 4CX20,000A has become the logical tube for high power FM transmitters. The Harris wideband quarterwave cavity does not have any troublesome fingerstock at high current points.

The cooling air system used in the Harris FM-25K1 complements the other major

stages in the transmitter—thoroughly designed, laboratory checked, then rechecked. A 335 CFM flushing fan keeps the main cabinet under positive air pressure keeping dust and dirt out. A single direct drive 2 H.P. blower provides sufficient cooling to 10,000 foot altitudes. The power dissipated by the 4CX20,000A is only 37% of its anode rating. Low dissipation, plus thoroughly designed cooling system, achieves typical tube lives of between 2 and 5 years.

Wide RF System Bandwidth

Overall RF system bandwidth in an FM transmitter is a major factor in determining total audio performance. The exceptionally low THD, IMD, and high separation specifications of the Harris MX-15 FM exciter are maintained throughout the broadband IPA and PA stages of the FM-25K1.

The exceptional 2.8 MHz RF bandwidth typically exhibited by the Harris FM-25K1 power amplifier stages is your assurance of minimum degradation to your audio signal. The Harris MX-15 exciter and FM-25K1 transmitter are a performance team capable of handling today's compact disc audio quality along with the higher frequency SCA channels in use.

Completely Solid State RF Driver

The power delivered by the MX-15 exciter is amplified first by a solid state 150 watt RF preamplifier. Typically, the preamplifier is required to deliver 80 watts, or only 53% of its rated capability.

The RF preamp drives a 600 watt solid state IPA stage which drives the final 4CX20,000A PA. The IPA stage is only re-

quired to develop typically 400 watts of power. At 400 watts, the IPA conservatively runs at 66% of its rating. The IPA module internally consists of two 300 watt sections. Each of these 300 watt sections is individually driven. Should a problem develop in either 300 watt section, on-the-air operation continues at a reduced transmitter power level. The FM-25K1's RF preamplifier and IPA are designed to withstand open and short circuit conditions.

For emergency conditions, the FM-25K1 has built-in RF **FLEXPatch** capability. Unlike competitive designs, the FM-25K1 uses a 50 ohm interstage impedance. This permits either the preamplifier, IPA, or even the final PA to be bypassed to permit continued operation at a reduced power. **FLEXPatch** can be operated by practically anyone.

Automatic Power Control

With a Harris FM-25K1 in service, operator output power adjustments practically are eliminated. The transmitter's controller automatically maintains output level. Operators no longer will be surprised to find AC line voltage swings creating over or under power conditions.

Automatic VSWR Foldback And VSWR Protection

In certain areas, heavy antenna icing conditions occur frequently causing antenna VSWR to increase and transmitters to shut down. Recognizing this, Harris has included as standard equipment a VSWR foldback protection circuit into the FM-25K1 that permits continued on-air operation at the safest operating power level.

This automatic circuit eliminates the need to call the station's engineer to make drastic reductions in operating power level. This circuit does not simply switch the transmitter to a fixed low power. Instead, it automatically reduces power to a level that permits continued safe operation. Further power reductions are made should the icing conditions grow more severe. When the ice begins to clear and the antenna VSWR decreases, the FM-25K1's output power is automatically increased to the highest level at which the transmitter can be operated until normal operation is restored.

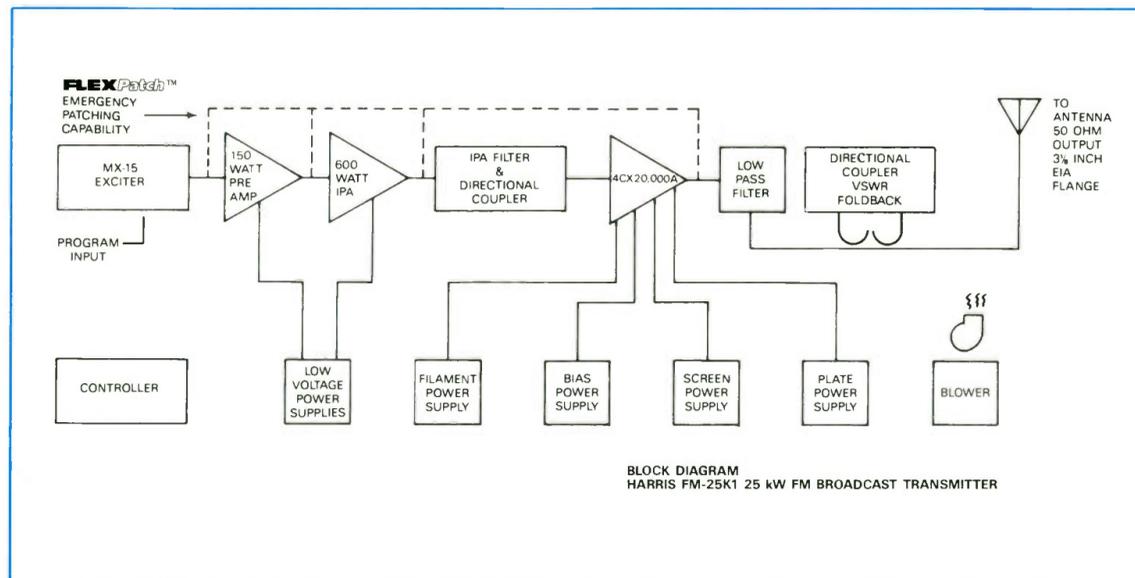
Instantaneous VSWR protection is also standard in the Harris FM-25K1. Should the load VSWR increase dramatically, the FM-25K1 will shut down and automatically recycle on. Should a high load VSWR be detected three times within 30 seconds, the FM-25K1 will remain off until a manual restart command is received.

The FM-25K1's automatic VSWR foldback circuit and instantaneous VSWR overload protection are designed to keep your station on the air at the highest safe operating level.

Control Circuitry

The FM-25K1 is controlled by solid-state logic circuitry. The logic circuitry not only control basic On/Off functions, but also monitors critical stages for overload conditions. Should an overload occur, the transmitter will recycle automatically, according to the number of times pre-set (one or three).

The control logic used in the FM-25K1 interfaces directly with most remote control



BLOCK DIAGRAM
HARRIS FM-25K1 25 KW FM BROADCAST TRANSMITTER

systems, eliminating the need for an additional remote control interface. The control signals are momentary low current contact closures. The transmitter output parameters are buffered, and all status indicators are remoted. This FM-25K1 feature allows stations to remote a wealth of diagnostic information to the remote control point.

Metering And Visual Aids

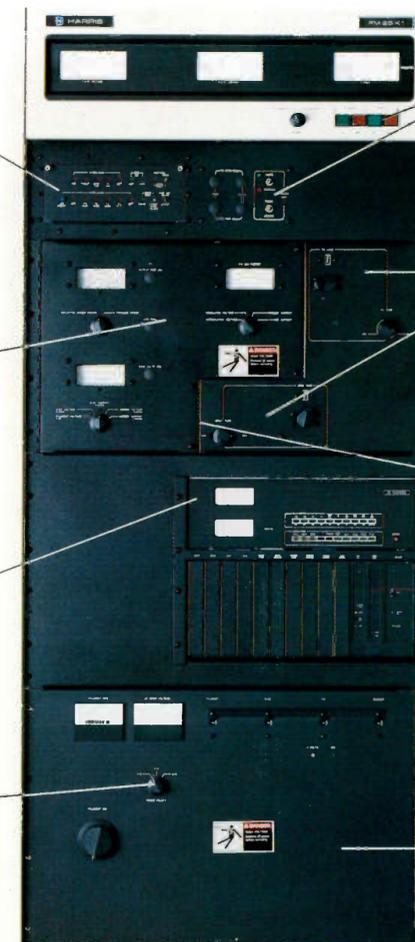
Major functions, including RF output, VSWR and PA parameters are displayed on easy-to-read four-inch meters. Low-level parameters are displayed on two multimeters. IPA forward and reflected power are indicated on another meter. Filament voltage is measured by a true RMS circuit to help achieve long tube life. A 3-phase AC line voltage meter is also standard along with an elapsed time meter. The FM-25K1 provides a variety of in-

The status display board shows at a glance the operating condition of the FM-25K1. Status output can also be remoted.

Extensive, easy to see multimeters monitor critical lower level circuits.

High performance MX-15 FM Exciter.

Standard elapsed time meter. 3 phase AC line voltage meter, and filament voltage rheostat provides the service aids to insure trouble-free operation.



All major operating parameters are easily displayed and grouped with the primary control switches.

Only four tuning controls make routine adjustments easy and convenient.

FLEXPatch™ can be operated by almost anyone, should a problem develop. (located behind access door.)

Major front panels are all hinged for easy maintenance.

dicators as trouble shooting aids and quick references. These include four illuminated On/Off pushbuttons and 26 LEDs, not including the up to 27 found on the MX-15 exciter.

HV Power Supply

The high voltage power supply is housed in a separate cabinet, and provides the plate and screen supplies. The conservatively rated three-phase plate supply uses silicon rectifiers.

Additional Features

There are many other standard operational and convenience features incorporated into the FM-25K1. These include:

Line-loss protection—Built-in protection against total AC failure and loss of phase is provided. The FM-25K1 will restart automatically following a total power

failure, while loss of a single phase will shut down the transmitter.

Additional protection—Four magnetic circuit breakers are utilized to protect the blower motor, the filament supply, the IPA supply and the bias supply. A wide-ranging interlock system and a drop solenoid system quickly discharge power supplies to safe levels.

Attention To Details

Quality details have been addressed on every FM-25K1 to minimize potential problems. For example, plug-in PC boards have gold-plated edge connectors to insure the highest contact reliability. All fabricated metal parts are individually treated to protect them from corrosive elements.

These are just a few examples of Harris quality standards at work for you now and for many years to come.

Harris MX-15 Exciter . . . new levels of excellence in FM audio performance

Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion is an exceptionally low .02%, with all CCIF Intermodulation distortion products below 80 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of ± 100 kHz.

Equally impressive is the FM-35K/MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the chance of ground loops and other system interface problems.

DIGITAL SYNTHESIZER

The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct comparison again WWV transmissions.

DIGITALLY SYNTHESIZED MODULATION

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Stereo separation typically exceeds 50 dB from 30 to 15,000 Hz.

OVERSHOOT COMPENSATION

A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds

overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality. Controlled transient response, high stereo separation, low crosstalk and low intermodulation distortion are all maintained with the increased loudness. The DTR filter can be switched off for stations whose formats do not require maximum modulation density.

MULTIPURPOSE SCA OPERATION

The MX-15 multipurpose SCA generator is designed to meet the expanded needs of today's SCA service requirements, and is ideal for high quality aural service or for accurate transmission of digital data.

The MX-15 multipurpose SCA generator can be user programmed to operate on 67 kHz or 92 kHz by simply positioning a jumper plug. Other operating frequencies can be easily accommodated upon request. Two SCA generators, one on 67 kHz and the other on 92 kHz, can simultaneously operate with stereo. The MX-15 exciter accommodates additional SCA channels through the composite input.

The transformerless audio input stage improves aural performance in comparison with other designs. Stations will note lower harmonic distortion for improved SCA fidelity.

The transformerless input stage is low pass filtered to meet the technical needs of the SCA information transmitted. A 4.5 kHz low pass response is provided as standard. This can be easily changed for 3 kHz, 5 kHz or 7.5 kHz response, or may be defeated if desired.

The MX-15 multipurpose SCA generator meets the transmission requirements of stations transmitting digital information. A rear mounted BNC input connector DC couples the digital data to the SCA generator's FM modulator for transmission quality.

SCA operators recognize that abrupt muting of the SCA carrier may cause an annoying "pop" in the SCA receivers. Harris has incorporated a carrier mute decay circuit to eliminate this objectionable noise.

In addition to the mute decay circuit, stations may select the mute delay time constant they desire—anywhere between 0.5 seconds and 20 seconds. Automatic mute threshold level can also be adjusted between 0 and -30 dBm in order to meet varying input levels.

The MX-15 exciter and multipurpose SCA generator work as an effective patented system to automatically maintain maximum main channel modulation at all times. Here's how: When the SCA generator is activated, the composite level is automatically lowered to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation when SCA is not used continuously.

Whether you are planning to use your SCA channel for conventional aural services (such as background music), or are looking at some of the new expanded applications possible today, the Harris MX-15 multipurpose SCA generator meets your needs.

POWER AMPLIFIER

The power amplifier module is conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL BENEFITS

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

A positive guidance system permits easy removal and reinsertion of all modules. All module signals and components can be checked during operation using the extender card supplied with the exciter. Engineers can appreciate these Harris convenience features when performing routine maintenance.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

FM-35K TRANSMITTER SPECIFICATIONS

GENERAL

POWER OUTPUT: 10 kW-35 kW (FCC type notified range).
PA EFFICIENCY: 80% minimum (14 kW to 35 kW).
FREQUENCY RANGE: 88 MHz-108 MHz (Tuned to single frequency).
RF LOAD IMPEDANCE: 50 ohm.
RF OUTPUT TERMINATION: 3" EIA female flanged.
PA MATCHING RANGE: 1.7:1 VSWR.
RF OUTPUT SPURIOUS AND HARMONIC: Meets or exceeds FCC requirements.
AC LINE VOLTAGE: 208-240 VAC, 50/60 Hz, 3-phase, WYE or closed delta OR 360-415 VAC, 50/60 Hz, 3-phase, 4-wire.
TRANSFORMER TAPS: 208V, 240V, (VERNIER: -10V, 0V, +10V).
PRIMARY POWER CONSUMPTION: Typically 52.2 kW (.95 PF) @ 35 kW.
INLET AIR: PA: 1650 CFM, HVPS 500 CFM.
SIZE AND WEIGHT
MAIN TRANSMITTER CABINET: Height 72 in., Width 33.5 in., Depth 33.5 in., Weight 600 lbs.
HIGH VOLTAGE POWER SUPPLY: Height 60.2 in., Width 52 in., Depth 26 in., Weight 1900 lbs.
AMBIENT TEMPERATURE: 0°C-50°C.
ALTITUDE: 10,000 ft. maximum, maximum temperature decreases 2°C per 1,000 ft. to 30°C.
HUMIDITY: 0-95% non-condensing.

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ± 75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).

COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 kHz 1:1 tone pairs).

COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ± 0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 55 dB below reference carrier with 100% AM modulation @ 400 Hz, 75 microsecond de-emphasis. (No FM modulation present).

SYNCHRONOUS AM SIGNAL TO NOISE: 50 dB below referenced carrier with 100% AM modulation @ 400 Hz, 75 microseconds de-emphasis. (FM modulation ± 75 kHz deviation @ 400 Hz).

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ± 1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25, 50 or 75 microsecond pre-emphasis.

HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: 0.1%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ± 75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).

STEREO OPERATION

TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: ± 10 dBm, ± 1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ± 0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.12% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 75 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -50 dB.
NON-LINEAR CROSSTALK: -60 dB.
76 kHz SUPPRESSION: -68 dB.
38 kHz SUPPRESSION: -73 dB.
FM NOISE: (Left or right) 72 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ± 75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ± 1 Hz 0° to 50°C.
OPERATIONAL MODES: Stereo mono (left and right), mono (left), mono (right)—remotable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 67 or 92 kHz programmable, any frequency between 25 and 92 kHz on special order.
FREQUENCY STABILITY: ± 500 Hz.
MODULATION CAPABILITY: ± 7.5 kHz.
AUDIO FREQUENCY RESPONSE: 67 kHz and 92 kHz AC coupled input, 150 microsecond pre-emphasis ± 1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis. DC to 4 kHz ± 0.5 dB.

AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ± 1 dB for 100% modulation at 400 Hz @ 600 ohms.

DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ± 5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).

FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = ± 5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 57 dB below ± 5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.

CROSSTALK: SCA to SCA (67 kHz/92 kHz) -50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).
CARRIER MUTE DECAY: Greater than 30 milliseconds.

EXCEPT WHEN NOTED, SPECIFICATIONS ARE REFERENCED TO 35 kW OPERATION.

HARRIS MAINTAINS A POLICY OF CONTINUOUS IMPROVEMENTS ON ITS EQUIPMENT AND THEREFORE RESERVES THE RIGHT TO CHANGE SPECIFICATIONS WITHOUT NOTICE.

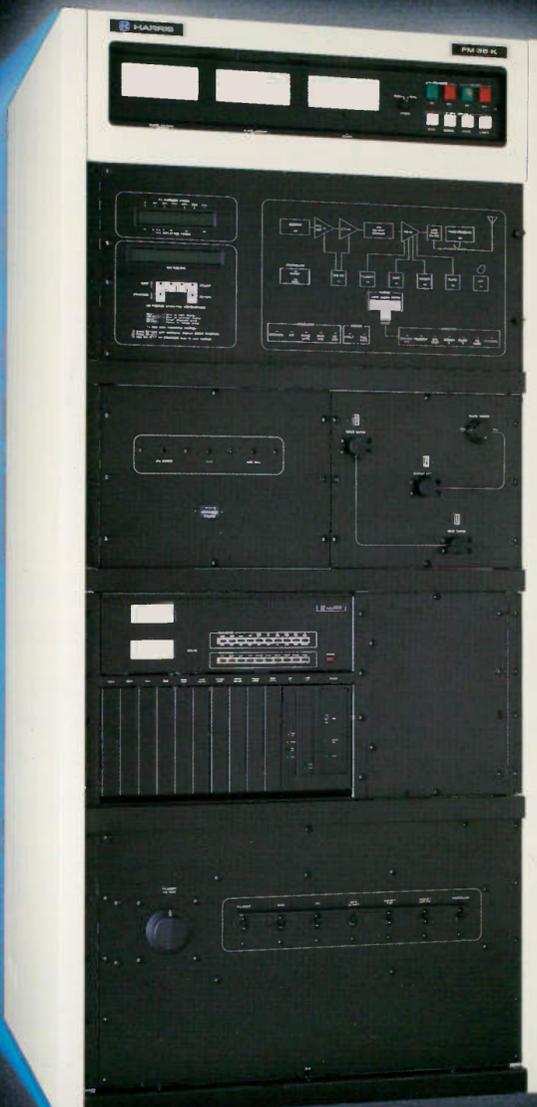
ORDERING INFORMATION

FM-35K, 35,000 Watt FM Broadcast Transmitter With MX-15 Exciter For Wideband Operation. Specify Carrier Frequency And 50 Hz OR 60 Hz AC Operation	994-8858-001
Spare 4CX20,000D Tube	374-0168-000
Mono Generator (Add For Mono Operation)	994-8019-001
DSM Stereo Generator With DTR Filter (Add For Stereo Operation)	994-8020-001
SCA Generator. Specify 67 kHz OR 92 kHz. (Add for SCA Operation)	994-7992-002
Sola Filament Voltage Regulator 60 Hz (Externally Mounted)	472-1250-000

HARRIS CORPORATION BROADCAST GROUP
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

HARRIS FM-35K, 35 kW FM TRANSMITTER

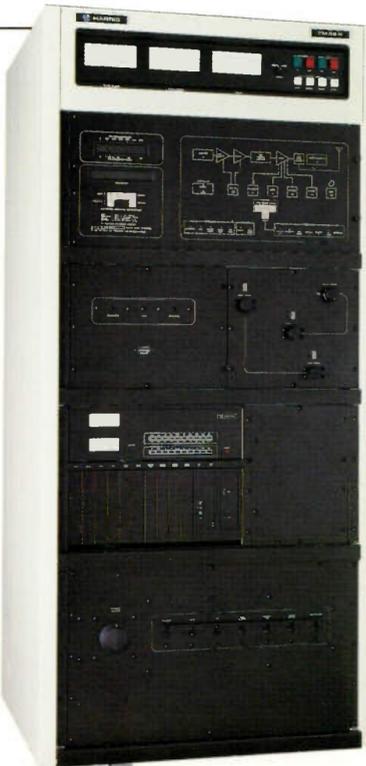
PowerStar™



Harris FM-35K PowerStar™

The right choice in high power, high performance FM transmitters

- Single tube, 10 - 35 kW high efficiency, high performance FM transmitter
- Advanced 4CX20,000D PA stage is 80% efficient for low operating costs, longer tube life
- Wide RF bandwidth provides signal transparency to exciter's audio performance
- Broadband solid state 150 watt RF preamp and 600 watt IPA stages with **FLEXPatch** capability
- High performance MX-15 exciter for maximum signal clarity
- Automatic VSWR foldback keeps station on the air during antenna icing conditions
- **COLORStat** front panel signal flow diagram immediately identifies problem stage
- Exclusive **STATUSPlus** controller memory records and stores exact date and time of overloads to help isolate problems



When considering high power FM transmitters, FM broadcasters generally consider three major requirements—long term reliability, operating costs, and audio performance. Without question, the Harris FM-35K meets these major requirements—and more...

POWER TO MEET YOUR TRANSMISSION SYSTEM'S REQUIREMENTS

The Harris FM-35K can provide any output power from 10 kW through 35 kW. This full range allows you to select the best combination of tower height, antenna gain, and transmitter power to accomplish your coverage goals.

ADVANCED, HIGHLY EFFICIENT PA STAGE

Every point of PA efficiency improvement

represents thousands of kilowatt hours of power saved over a single year. This amounts to thousands of dollars saved in AC power costs during the life cycle of the transmitter.

In order to achieve the utmost in PA efficiency, Harris, working with tube manufacturers, helped to develop the new 4CX20,000D power tetrode—a high performance version of the popular 4CX20,000A/8990. When matched with the Harris FM-35K PA cavity, 80% PA stage efficiency is obtained. This is the highest PA efficiency of any high power FM broadcast transmitter currently on the market. And, unlike other designs, the Harris FM-35K maintains 80% PA efficiency over the wide power range of 14 kW through 35 kW.

The development and introduction of the

4CX20,000D is a continuation of Harris' RF engineering expertise at work. In 1978, Harris helped to develop and introduce the first in this family of tubes, the 4CX20,000A. The 4CX20,000A, since that time, has become a standard in such 25 kW transmitter designs as the Harris FM-25K.

The cooling air system used in the Harris FM-35K complements the other major stages in the transmitter—thoroughly designed, laboratory checked, then rechecked. A single direct drive 3 H.P. blower provides sufficient cooling to 10,000-foot altitudes.

Not only will the FM-35K's high PA efficiency save thousands of dollars in power costs over a ten-year period, but the thorough cooling will help to assure exceptional tube life.

WIDE RF SYSTEM BANDWIDTH

Overall RF system bandwidth in an FM transmitter is a major factor in determining total audio performance. The exceptionally low THD, IMD, and high separation specifications of the Harris MX-15 FM exciter are maintained throughout the broadband IPA and PA stages of the FM-35K.

The exceptional 2.2 MHz RF bandwidth typically exhibited by the Harris FM-35K power amplifier stages is your assurance of minimum degradation to your audio signal. The Harris MX-15 exciter and FM-35K transmitter are a performance team capable of handling today's compact disc audio quality along with the higher frequency SCA channels in use.

COMPLETELY SOLID STATE RF DRIVER

The power delivered by the MX-15 exciter is amplified first by a solid state 150 watt RF preamplifier. The supply voltage to the preamplifier is smoothly ramped up during initial PA stage start up, minimizing stress. Typically, the preamplifier is required to deliver 80 watts, or only 53% of its rated capability.

The RF preamp drives a 600 watt solid state IPA stage which drives the final 4CX20,000D PA. The IPA module internally consists of two 300 watt sections. Each of these 300 watt sections is individually driven. Should a problem develop in either 300 watt section, on-the-air operation continues at a reduced transmitter power level. The FM-35K's RF preamplifier and IPA are designed to withstand open and short circuit conditions.

For emergency conditions, the FM-35K has built-in RF **FLEXPatch** capability. Unlike com-

petitive designs, the FM-35K uses a 50 ohm interstage impedance. This permits either the preamplifier, IPA, or even the final PA to be bypassed to permit continued operation at a reduced power. When the 600W IPA is patched into the antenna, a front panel controller switch disables all PA power supplies.

AUTOMATIC POWER CONTROL

With a Harris FM-35K in service, operator output power adjustments practically are eliminated. The transmitter's controller automatically maintains output level. Operators no longer will be surprised to find AC line voltage swings creating over or under power conditions.

AUTOMATIC VSWR FOLDBACK AND VSWR PROTECTION

In certain areas, heavy antenna icing conditions occur frequently causing antenna VSWR to increase and transmitters to shut down. Recognizing this, Harris has included as standard equipment a VSWR foldback protection circuit into the FM-35K that permits continued on-air operation at the safest operating power level.

This automatic circuit eliminates the need to call the station's engineer to make drastic reductions in operating power level. This circuit does not simply switch the transmitter to a fixed low power. Instead, it automatically reduces power to a level that permits continued safe operation. Further power reductions are made should the icing condition grow more severe. When the ice begins to clear and the antenna VSWR decreases, the FM-35K's output power is automatically increased to the highest level at which the transmitter can be operated until normal operation is restored.

Instantaneous VSWR protection is also standard in the Harris FM-35K. Should the load VSWR increase dramatically, the FM-35K will shut down and automatically recycle on. Should a high load VSWR be detected three times within 30 seconds, the FM-35K will remain off until a manual restart command is received.

The FM-35K's automatic VSWR foldback circuit and instantaneous VSWR overload protection are designed to keep your station on the air at the highest safe operating level.

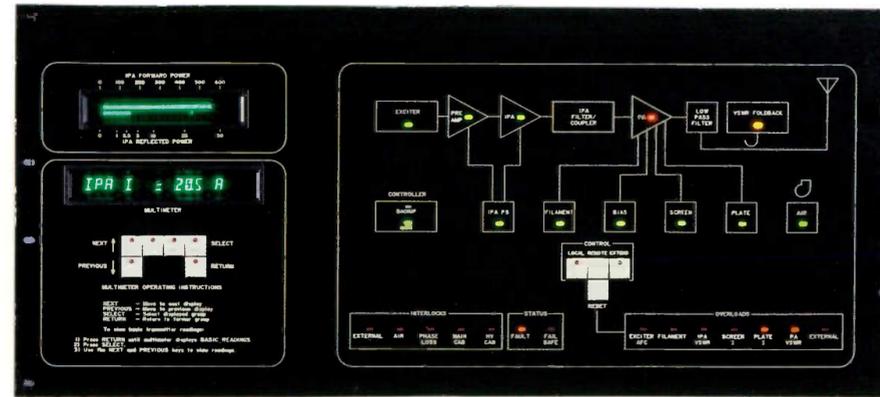
COLORStat FLOW DIAGRAM

Another exclusive feature found in the Harris FM-35K is **COLORStat**, a front panel signal flow block diagram. This 17-inch by 10-inch prominently located diagram contains representative blocks of each of the FM-35K's major operating functions. Associated with each function are tri-colored LEDs. Under normal operation, the LED for the particular stage will be green. An abnormal, yet still functional, condition will turn the LED amber, and a complete stage failure is indicated by a red LED.

This useful status display is very simple and straightforward, permitting problem diagnosis by any operator.

STATUSPlus METERING

The front panel **STATUSPlus** alpha-numeric multimeter incorporated into the Harris FM-35K makes routine parameter checks easy and straightforward. This display simultaneously indicates the parameter being measured along with the measured value in correct units. Access to over 50 measurements is provided. Displayed parameters such as plate current or screen current also have their corresponding



Color keyed signal flow diagram makes problem isolation very easy. Alpha-numeric multimeter monitors every important parameter.

overload set points displayed. At a glance, the station's technician can quickly check for proper overload settings.

Associated with the **STATUSPlus** alpha-numeric multimeter is a dual horizontal bar IPA power meter. Here, both forward and reflected IPA power are simultaneously displayed, making tuning adjustments very simple.

OVERLOAD, DATE, TIME MEMORY

Another Harris FM-35K exclusive, the **STATUSPlus** feature automatically logs the date and time when any of seven major overloads occurs. This sequential information is stored continuously in the FM-35K's control memory. The overload history is simply recalled via the front panel alpha-numeric multimeter. There is no better way to quantify the nature and frequency of overload conditions.

ADVANCED CONTROL DESIGN

The FM-35K incorporates an advanced microprocessor-based control and monitoring system. Based on an industry standard STD bus structure, the controller executes the many commands and "housekeeping chores" required for proper transmitter operation.

Additional controller expansion slots have been provided to accept future FM-35K enhancements as they become available.

Operating in parallel with the main controller is a discrete logic back-up controller. This back-up unit automatically assures basic operation should the main controller develop a problem. Switch-over to the back-up controller is automatic and does not take the FM-35K off the air. Under back-up operations, the main controller plug-in cards can be removed for service without loss of air time.

An LED status display panel is associated with both controllers. Here, output commands to power relays, etc., are monitored to insure both controllers are executing tasks properly. This feature quickly helps to isolate problems between the controller and controlled devices.

STANDARD REMOTE CONTROL AND EXTENDED CONTROL INTERFACE

The Harris FM-35K has been designed to interface with simple or full-featured remote control systems. Interface has been divided into two control points: 1) remote control, and/or 2) extended control. Front panel controller switches select the desired control points.

Remote and extended control systems are provided with four buffered analog signals, in addition to 10 control input commands, and 16 status output signals.

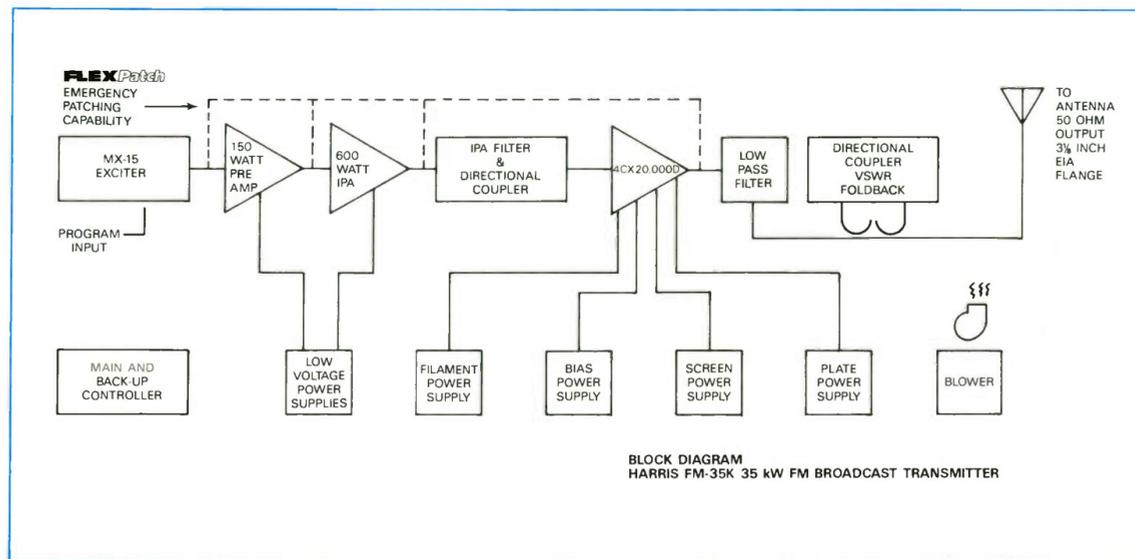
CONVENIENT INTERFACE

All small signal input and output connections on the FM-35K are made on a conveniently located interface panel. Many of the interface points can be further remoted to an adjacent equipment rack with the use of industry standard D type connector extension cables.

ATTENTION TO DETAILS

Quality details have been addressed on every FM-35K to minimize potential problems. For example, plug-in PC boards have gold-plated edge connectors to insure the highest contact reliability. All fabricated metal parts are individually treated to protect them from corrosive elements.

These are just a few examples of Harris quality standards at work for you now and for many years to come.



Service accessibility has been well planned in the FM-35K. Additional controller slots have been provided for future product enhancements.

Harris MX-15 Exciter . . . new levels of excellence in FM audio performance



Continuing in its trend-setting tradition, Harris has utilized state-of-the-art refinements in FM exciter technology in developing the MX-15 FM Exciter. Using various advanced techniques, such as DTR (Dynamic Transient Response) and DSM (Digitally Synthesized Modulation), the MX-15 Exciter and stereo generator provide the broadcaster with new levels of excellence in audio performance.

ULTRA-LINEAR VCO

The unique VCO (Voltage Controlled Oscillator) of the MX-15 features superb linearity and extremely low signal-to-noise, not found in conventional modulated oscillator designs.

Wideband Composite Intermodulation Distortion through the FM-5K1 is an exceptionally low .08%, with all CCIF Intermodulation distortion products down at least 80 dB. This important parameter demonstrates the precision of the VCO—the heart of any exciter. Composite input signals between 30 Hz and 53 kHz will not be slew limited even at maximum modulation capability of 133%.

Equally impressive is the FM-5K1/MX-15's -80 dB FM Signal-To-Noise Ratio specification. An exclusive externally induced hum cancellation circuit allows the transmitter to achieve this low noise floor. The MX-15's exceptionally low distortion and noise performance provide your station with maximum signal clarity.

BALANCED FLOATING COMPOSITE INPUT

Recognizing that many FM broadcasters operate composite systems or use external stereo generators in the audio processing chain, the Harris MX-15 offers a balanced floating composite input as a standard feature. This input reduces the probability of ground loops and other system interface problems.

DIGITAL SYNTHESIZER

The MX-15 uses a 10 MHz high-stability TCXO (Temperature Compensated Reference Oscillator) and programmable divider chain in its dual-state phase locked loop AFC system. The synthesizer provides outputs at 2.5, 5, 10, 15, 20 and 25 MHz, permitting direct frequency comparison against WWV transmissions.

DIGITALLY SYNTHESIZED MODULATION

The Harris DSM stereo generation technique provides a clean stereo composite signal. Unlike conventional technology, the Harris DSM technique does not suffer from reduced separation at the upper and lower audio spectrum and/or poor harmonic rejection resulting in degraded crosstalk. DSM stereo generation is essentially transparent to the program material. Stereo separation typically exceeds 50 dB from 30 to 15,000 Hz.

OVERSHOOT COMPENSATION

A Dynamic Transient Response (DTR) filter, developed and patented by Harris, holds

overshoot on any program material to 2% or less. As a result, 2 to 6 dB increased loudness can be achieved with no degradation of audio quality.

MULTIPURPOSE SCA OPERATION

The MX-15 multipurpose SCA generator is designed to meet the expanded needs of today's SCA service requirements, and is ideal for high quality aural service or for accurate transmission of digital data.

The MX-15 multipurpose SCA generator can be user programmed to operate on 67 kHz or 92 kHz by simply positioning a jumper plug. Other operating frequencies can be easily accommodated upon request. Two SCA generators, one on 67 kHz and the other on 92 kHz, can simultaneously operate with stereo. The MX-15 exciter accommodates additional SCA channels through the composite input.

The transformerless audio input stage improves aural performance in comparison with other designs. Stations will note lower harmonic distortion for improved SCA fidelity.

The transformerless input stage is low pass filtered to meet the technical needs of the SCA information transmitted. A 4.5 kHz low pass response is provided as standard. This can be easily changed for 3 kHz, 5 kHz or 7.5 kHz response, or may be defeated if desired.

The MX-15 multipurpose SCA generator meets the transmission requirements of stations transmitting digital information. A rear mounted BNC input connector DC couples the digital data to the SCA generator's FM modulator for transmission quality.

SCA operators recognize that abrupt muting of the SCA carrier may cause an annoying "pop" in the SCA receivers. Harris has incorporated a carrier mute decay circuit to eliminate this objectionable noise.

In addition to the mute decay circuit, stations may select the mute delay time constant they desire—anywhere between 0.5 seconds and 20 seconds. Automatic mute threshold level can also be adjusted between 0 and -30 dBm in order to meet varying input levels.

The MX-15 exciter and multipurpose SCA generator work as an effective patented system to automatically maintain maximum main channel modulation at all times. Here's how: When the SCA generator is activated, the composite level is automatically lowered to allow for insertion of the SCA channel. The converse is also true. Stations need not compromise 10% to 30% of modulation when SCA is not used continuously.

Whether you are planning to use your SCA channel for conventional aural services (such as background music), or are looking at some of the new expanded applications possible today, the Harris MX-15 multipurpose SCA generator meets your needs.

POWER AMPLIFIER

The MX-15 power amplifier module is solid-state, conservatively rated at 15 watts output, and requires no tuning. VSWR protection prevents accidental damage to the module.

STATUS AND MONITORING

Status and LED indicators are used throughout to aid in troubleshooting. Metering is provided to monitor 10 DC and 10 audio parameters. A peak reading audio voltmeter aids in setting up the exciter on tones, and can serve as an accurate peak program indicator, with accuracy approaching that of a modulation monitor. When fully equipped, the MX-15 contains 27 front panel status indicators for quick "go/no-go" service checks.

ADDITIONAL BENEFITS

The MX-15 mainframe is ruggedly constructed, with all major printed circuit boards housed in their own shielded, plug-in enclosure.

Composite wideband, Mono and Stereo audio inputs are transformerless and balanced to give maximum common mode rejection while maintaining excellent response. Inputs will withstand high transients or steady state voltages above or below ground reference.

The basic MX-15 Exciter is wideband and can be used without interface, directly with a composite stereo studio/transmitter link (STL) or external stereo generator.

FM-5K1 TRANSMITTER SPECIFICATIONS

GENERAL

POWER OUTPUT: 1500 Watts to 5000 Watts.
FREQUENCY RANGE: 87.5 to 108 MHz, tuned to specified operating frequency.
RF OUTPUT IMPEDANCE: 50 ohms.
OUTPUT TERMINATION: 1 1/4" EIA flange.
FREQUENCY STABILITY: ±300 Hz 0° to 45°C TCXO.
TYPE OF MODULATION: Direct Carrier Frequency Modulation (DCFM).
MODULATION CAPABILITY: 133%.
AC INPUT POWER: 197/250 V, 60 or 50 Hz, single phase, two wire. Power consumption: 10 kW watts (approx.). 60 or 50 Hz, 150 watts for MX-15.
RF HARMONICS: Suppression meets all FCC requirements.
ALTITUDE: 10,000 ft./60 Hz, 7500 ft./50 Hz.
AMBIENT TEMPERATURE RANGE: -20°C to +45°C.
MAXIMUM VSWR: 2.0:1.
OVERALL CABINET SIZE: 33" W (84 cm) × 72" H (182 cm) × 34" D (99 cm).
FINISH: White, blue and black.
WEIGHT & CUBAGE: Export: 46.7 cu. ft. (1.322 cu. m); Weight 925 lbs. domestic (420 Kg); 1025 lbs. export (470 Kg.)

WIDEBAND COMPOSITE OPERATION

COMPOSITE INPUT: One balanced floating input.
COMPOSITE INPUT IMPEDANCE: 2000 ohms resistive.
COMPOSITE INPUT CONNECTOR: Female BNC.
COMPOSITE INPUT LEVEL: 1.0 volt RMS nominal for ±75 kHz deviation.
EXTERNAL SCA GENERATOR INPUTS: Up to two unbalanced inputs (optional).
COMPOSITE FM SIGNAL TO NOISE: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation with 75 microsecond de-emphasis, 20 Hz to 200 kHz bandwidth).
COMPOSITE HARMONIC DISTORTION: .08%.
COMPOSITE INTERMODULATION DISTORTION: .02% (60 Hz/7 kHz 1:1 tone pairs).
COMPOSITE CCIF INTERMODULATION DISTORTION: All distortion products below 80 dB (reference 14 kHz/15 kHz test tone pair).
COMPOSITE AMPLITUDE RESPONSE: ±0.1 dB, 30 Hz-53 kHz.
ASYNCHRONOUS AM SIGNAL TO NOISE: 55 dB below reference carrier AM modulation 100% output power.
SYNCHRONOUS AM SIGNAL TO NOISE: -50 dB.

MONAURAL OPERATION

AUDIO INPUT IMPEDANCE: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.
INPUT FILTER: Controlled response low pass filter, defeatable.
AUDIO INPUT LEVEL: +10 dBm ±1 dB for 100% modulation at 400 Hz.
AUDIO FREQUENCY RESPONSE: Standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
HARMONIC DISTORTION: 0.15%, 30 Hz to 15 kHz de-emphasized.
INTERMODULATION DISTORTION: .045%, 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: All distortion products down 70 dB (reference 14 kHz/15 kHz test tone pair).
FM SIGNAL TO NOISE RATIO: 80 dB below 100% modulation (reference 400 Hz @ ±75 kHz deviation, measured 20 Hz to 200 kHz bandwidth, 75 microsecond de-emphasis).
STEREO OPERATION
TYPE OF MODULATION: Digitally Synthesized Modulation (DSM).
AUDIO INPUT IMPEDANCE: Left and right channels: 600 ohms, balanced, resistive, transformerless, adaptable to other impedances.

AUDIO INPUT LEVEL: +10 dBm, ±1 dB for 100% modulation.
AUDIO FREQUENCY RESPONSE: (Left and right) standard 75 microsecond FCC pre-emphasis curve ±0.5 dB, 30 Hz-15 kHz. Selectable: flat, 25 or 50 microsecond pre-emphasis.
INPUT FILTERING: 15 kHz low pass filter, 45 dB rejection at 19 kHz.
OVERSHOOT PROTECTION: Harris patented Dynamic Transient Response (DTR) filter. Defeatable for test purposes.
AUDIO TRANSIENT RESPONSE: 2% maximum overshoot beyond steady state.
HARMONIC DISTORTION: (Left or right) 0.2% or less, 30-15,000 Hz.
INTERMODULATION DISTORTION: (Left or right) 0.1% 60 Hz/7 kHz test tone pair, 4:1 ratio.
CCIF INTERMODULATION DISTORTION: (Left or right) all distortion products down 75 dB (reference 14 kHz/15 kHz test tone pair).
STEREO SEPARATION: 50 dB, 30 Hz-15 kHz; typically 60 dB at midband frequencies.
DYNAMIC STEREO SEPARATION: 48 dB under normal programming conditions.
LINEAR CROSSTALK: -50 dB.
NON-LINEAR CROSSTALK: -60 dB.
76 kHz SUPPRESSION: -68 dB.
38 kHz SUPPRESSION: -73 dB.
FM NOISE: (Left or right) 72 dB minimum below 100% modulation. Reference: 400 Hz, 75 microsecond de-emphasis, ±75 kHz deviation, measured 30 Hz to 15 kHz bandwidth.
PILOT OSCILLATOR: Crystal controlled.
PILOT PHASE: Harris patented automatic pilot phasing circuit.
PILOT STABILITY: 19 kHz ±1 Hz 0° to 50°C.
OPERATIONAL MODES: Stereo, mono (left and right), mono (left), mono (right)—remoteable.

SCA OPERATION

MODULATION: Direct FM.
FREQUENCY OF OPERATION: 67 or 92 kHz programmable, any frequency between 25 and 92 kHz on special order.
FREQUENCY STABILITY: ±500 Hz.
MODULATION CAPABILITY: ±7.5 kHz.
AUDIO FREQUENCY RESPONSE: 67 kHz and 92 kHz AC coupled input, 150 microsecond pre-emphasis ±1 dB, standard. Selectable flat, 50 or 75 microsecond pre-emphasis. DC coupled input: No pre-emphasis: DC to 4 kHz ±0.5 dB.
AUDIO INPUT IMPEDANCE: 600 ohms balanced (AC coupled). Also 2000 ohms DC coupled unbalanced input through rear BNC connector.
AC INPUT LEVEL: +10 dBm, ±1 dB for 100% modulation at 400 Hz @ 600 ohms.
DC INPUT LEVEL: 1.0 volt peak for 5 kHz deviation.
INPUT FILTERING: Programmable LPF, 4.5 kHz standard. 3 kHz, 5 kHz, 7.5 kHz selectable. Low pass filter defeatable.
HARMONIC DISTORTION: 0.5%, 30-4,500 Hz ±5 kHz deviation.
INTERMODULATION DISTORTION: 1%, 60 Hz/7 kHz, 1:1 ratio (audio low pass filter and pre-emphasis bypassed).
FM NOISE: (Main channel not modulated) -63 dB (reference: 100% modulation = ±5 kHz deviation at 400 Hz).
CROSSTALK: (SCA to main or stereo sub-channel) -60 dB or better.
CROSSTALK: (Main or stereo sub-channel to SCA) 55 dB below ±5 kHz deviation of SCA with mono or stereo channels modulated by frequencies 30 Hz-15 kHz, SCA demodulated with 150 microsecond de-emphasis.
CROSSTALK: SCA to SCA (67 kHz/92 kHz) -50 dB demodulated with 150 microsecond de-emphasis.
AUTOMATIC MUTE LEVEL: Variable from 0 to -30 dBm.
MUTE DELAY: Adjustable 0.5 to 20 seconds.
INJECTION LEVEL: 1% to 30% of composite level (adjustable).

Specifications subject to change without notice.

ORDERING INFORMATION

FM-5K1, 5 kW FM Broadcast Transmitter with MX-15 Exciter for wideband operation, 197 to 250 VAC, Single Phase 50 or 60 Hz (specify)	994-9009-001
Options	
Constant Voltage Filament Regulator Transformer	472-0586-000 for 60 Hz
	472-1244-000 for 50 Hz
Spare 4CX3500A PA Tube	374-0169-000
Mono Generator (Add For Mono Operation)	994-8019-001
Harris DSM Stereo Generator (For Stereo Operation)	994-8020-001
Harris SCA Generator (67 or 92 kHz Operation)	994-7992-002

HARRIS CORPORATION BROADCAST GROUP
P. O. BOX 4290, QUINCY, ILLINOIS 62305-4290 U.S.A. 217/222-8200

FM-5K1 5-kilowatt FM broadcast transmitter



Harris FM-5K1...even more than you bargained for in a high-performance FM transmitter

- 1500 to 5000 watt output power range
- MX-15 exciter for minimum distortion, maximum signal clarity
- Single phase AC eliminates need for costly 3-phase service
- Automatic power control minimizes operator adjustment
- Automatic VSWR foldback helps keep transmitter on air during antenna icing conditions
- Front panel block diagram display helps isolate problems, minimize down time
- Full remote control interface included



When considering 5 kW FM transmitters, FM broadcasters in general have two major requirements—long term reliability and audio performance. Without question the Harris FM-5K1 meets these crucial requirements and more.

POWER TO MEET YOUR TRANSMISSION SYSTEM'S REQUIREMENT

The Harris FM-5K1 can provide any output power from 1500 to 5000 watts. This full range allows you to select the most effective antenna size, tower height and transmission line combination to meet your coverage requirements.

The FM-5K1 consumes only 10 kW of power at 5 kW output. Based on an 18 hour broadcast day and a typical power charge of 8¢ per kilowatt hour, this represents an operating cost of only \$14.40 per day.

Even at full 5 kW output, the FM-5K1 requires only single phase AC power. Unlike other transmitters in this power range, there is no need to bring in costly 3-phase AC service to your facility.

HIGHLY RELIABLE, LONG LIFE POWER AMPLIFIER DESIGN

The Harris FM-5K1 utilizes a modern power

amplifier chain that provides you with many years of dependable service.

The high performance Harris MX-15 FM exciter begins the RF chain by delivering 15 watts of power.

The MX-15 is followed by an all solid state 150 watt driver stage which has been specifically designed not to degrade the MX-15's high quality signal. The driver will survive any load condition from opens to shorts. Typically required to produce only 100 watts of drive, the amplifier loafs at one-half its power capability. Should servicing ever be required, the driver is housed

in a modular enclosure which can be quickly removed.

The long life 4CX3500A power tetrode is especially designed for broadcast service. Harris engineers have designed the PA to dissipate only 40% of the tube's rated anode capability for long tube life and reliable operation.

EMERGENCY PA PATCHING CAPABILITY

Station engineers will appreciate the 50 ohm interface used between the exciter, driver, and power amplifier. This Harris feature permits the exciter to be routed directly into the PA, or the IPA to be routed directly into the antenna. This flexibility allows you to remain on the air at reduced power should a stage fail. In most instances,

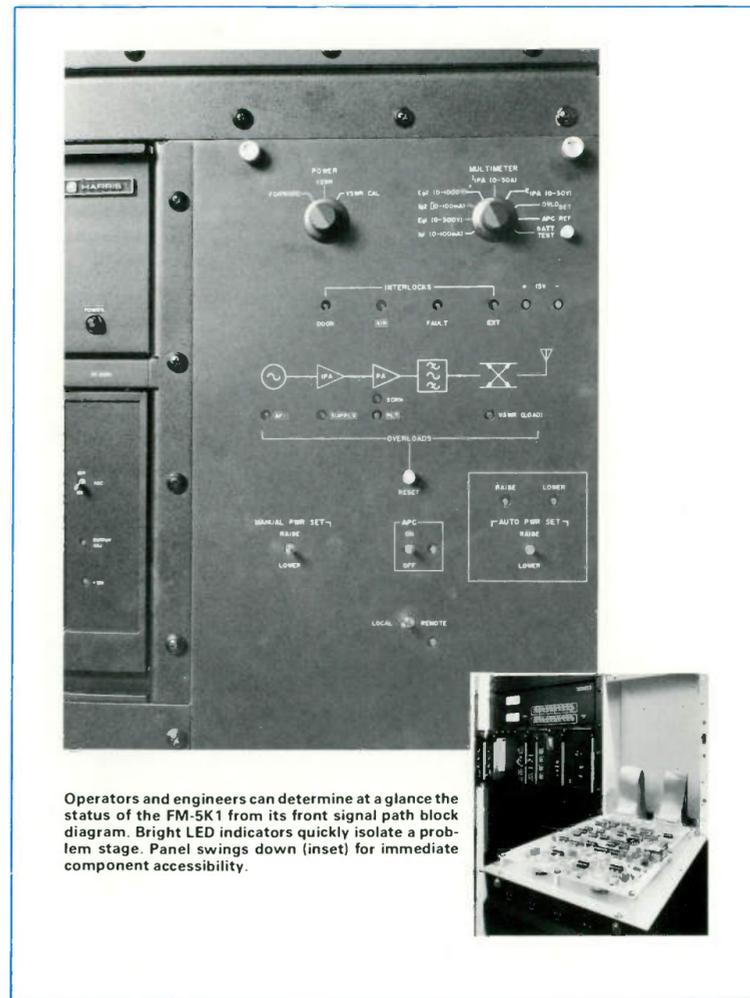
reduced power operation will provide you with a surprisingly good signal over your main coverage area.

BANDPASS OUTPUT NETWORK

Broadcast transmitter locations are growing more congested with other radio services. Therefore, Harris has incorporated a unique bandpass output network into the FM-5K1 to reduce signal interference from other RF services.

TRANSMITTER CONTROL AND STATUS AT A GLANCE

The FM-5K1's control and status section features a straightforward design that controls and monitors all vital areas to insure top performance. Operators and engineers can determine at a glance the status of the



Operators and engineers can determine at a glance the status of the FM-5K1 from its front signal path block diagram. Bright LED indicators quickly isolate a problem stage. Panel swings down (inset) for immediate component accessibility.

FM-5K1 from its front panel signal path block diagram display. Bright LED indicators signal circuit status in each major functional stage. These indicators have fault memory in case of power failure.

Station engineers will appreciate the 9-position multimeter that monitors low level stages. A separate true RMS filament voltmeter and front panel control make filament voltage metering and adjustment convenient to optimize tube life.

Automatic Power Control. With a Harris FM-5K1 in service, the need for operator output power adjustments is practically eliminated as its precision automatic power control unit maintains output power to within 5%. Operators will no longer be surprised to find that the station has been operating above or below power for some time due to line voltage fluctuations. The Harris FM-5K1 eliminates this operator concern and constantly maintains authorized power.

Automatic VSWR Foldback. In certain areas, heavy icing conditions occur frequently, often causing antenna VSWR to rise and transmitters to shut down. Recognizing this, Harris engineers have included an automatic VSWR foldback circuit that permits continued safe operation under high VSWR conditions at reduced power. Since this FM-5K1 feature is automatic, there is no need to call the station's engineer to adjust controls or retap transformers. When the VSWR condition clears, normal high power operation is automatically restored.

AC Restart. As momentary power outages are common, the FM-5K1 is equipped with automatic AC restart to immediately return the transmitter to service when power is restored.

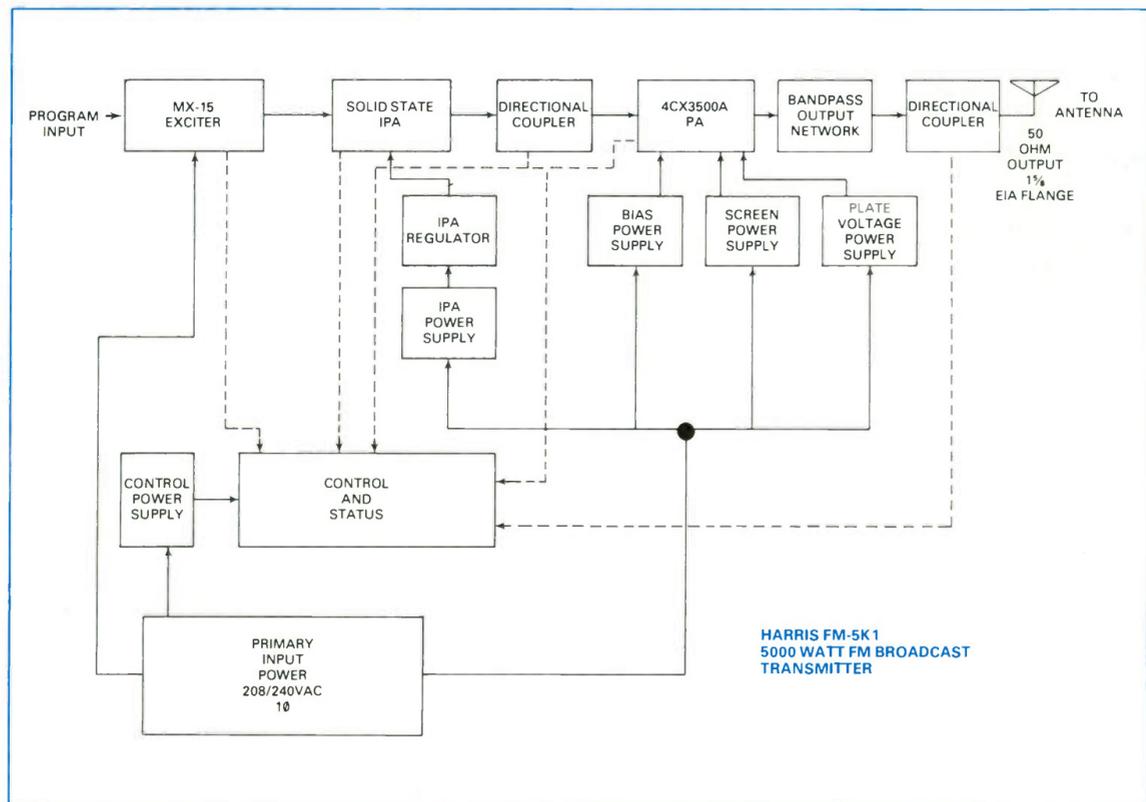
REMOTE CONTROL INTERFACE INCLUDED

Unlike other FM transmitters, remote control interface is an integral part of the FM-5K1—not an expensive option. Momentary contact closure, suitable for all popular remote control systems, is all that is required for the typical on/off, raise/lower functions. Analog meter samples, along with status lights, are also available for remote control interface.

ATTENTION TO DETAILS

Quality details have been addressed on every FM-5K1 to minimize potential problems. For example, all plug-in PC boards have gold plated edge connectors to insure the highest contact reliability. All fabricated metal parts are individually treated to protect them from corrosive elements.

These are just a few examples of Harris quality standards at work for you now and for many years to come.



HARRIS FM-5K1 5000 WATT FM BROADCAST TRANSMITTER